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Martin Magne

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ARCHAEOLOGY IN ALBERTA, 1987

By

John W. Ives
Archaeological Survey of Alberta

The key event for archaeology in Alberta in 1987 was the opening of the Head-Smashed-In Buffalo Jump Interpretive Centre, northwest of Fort Macleod. On July 23, as part of three days of celebrations, including a powwow with a tipi village and dancing, the Duke and Duchess of York opened this ten million dollar facility designed to interpret Native lifestyles and operation of the buffalo jump over the last 5,700 years. The centre was an immediate success, and by September of 1987 the new facility had already attracted 100,000 visitors. Little more than a year later, the 250,000th visitor is expected to enter the building in a few weeks.

The opening of the interpretive centre marked the culmination of five years of collaborative effort between the Historic Sites Service and the Archaeological Survey of Alberta. Planning for Head-Smashed-In also involved extensive collaboration with Peigan elders. Close cooperation with the Peigan and Blood has continued as interpretive activities and archaeological research have created important local employment opportunities. In a very positive way, Head-Smashed-In has become the focus for a variety of Native activities in southwestern Alberta.

Among the many benefits of the centre, of course, has been the opportunity to convey to a much broader public the value and significance of archaeological work in understanding the past. Archaeological Survey of Alberta research at Head-Smashed-In will involve ongoing excavations in the camp and processing area of the site, and visitors have genuinely appreciated their chance to see archaeological work in progress from May through September. Jack Brink and Bob Dawe report in this volume on those activities for 1987.

The field season for 1987 also saw the first tangible efforts towards the First Albertans Research Project. (Passages in the following remarks have also appeared in a Canadian Archaeological Association Bulletin compiled by Bruce Ball.) The project is intended as a study of the initial human occupation of the province, with temporal boundaries set by the first evidence of human presence in the "ice-free corridor" and extending forward in time to late Palaeo-Indian settlement of Alberta. The key effort will be directed towards systematic survey and testing in the 900 km segment of the corridor along Alberta's Eastern Slopes region. The sheer size and frequently remote and forested character of this study area present formidable problems. Yet any success in identifying a human presence within the corridor more than 11,800 years ago would have a significant bearing upon the larger issue of how the entire New World was first populated.

Brian Ronaghan and Alwynne Beaudoin report in this volume on some of this work along the upper North Saskatchewan River. Other Archaeological Survey of Alberta work on this project in 1987 came with Milt Wright's activity in the Grande Prairie region. He made an initial survey of a 7,500 square kilometre area around glacial Lake Peace, which dates to c. 15,000 to 11,000 years B.P. Helicopter reconnaissance to the southwest of Grande Prairie focussed on probable shoreline and channel features associated with glacial Lake Peace. An alternative strategy has involved recording of potentially attractive occupation locations, such as caves, rock shelters and resource locations (e.g., springs, lithic outcrops, game intercepts). Promising locations mapped in 1987 will be selected for test excavation in subsequent field seasons.

Collections research in the Grande Prairie and Birch Hills areas continues to provide promising results, adding to an inventory which now includes over 65 collections. Several of the collections include small fluted points similar to the "Charlie Lake Cave" type. Other fluted points in the collections are more formalized, displaying guide flakes for the central channel flake. The majority of the fluted specimens originate from eastern regions of the Birch Hills, which was formerly a peninsula of glacial Lake Peace. This area also has yielded Hell Gap, Plainview, Scottsbluff and Alberta point types, along with Cody knives. Raw materials provide ample evidence of local manufacture.

J. Rod Vickers initiated formal excavation of the Fletcher site, DjOw-1, an Early Prehistoric Period bison kill site first excavated and reported by Richard G. Forbis in 1968. Excavation of a single 2 x 2 m unit was undertaken to clarify stratigraphy and to recover samples for radiocarbon dating and identification of palaeoenvironmental remains. Significant palaeoenvironmental remains, including snail and plant macrofossils, have been identified at the base of a water-saturated bone deposit at a 2 m depth. These specimens will provide important data for modeling early post-glacial climate in the Plains region. While three Alberta-Scottsbluff points were recovered from the surface of disturbed site deposits, no lithic remains were encountered in the lower levels of the excavation. This is not unusual since previous excavations also produced low recovery fractions on the order of 1 item per 6 square metres of excavated area. Similarly low returns were noted at the Hudson-Meng site in Nebraska, a site of comparable temporal and cultural characteristics. Excavation of the Fletcher site is planned to continue in 1988.

Alwynne Beaudoin continued palaeoenvironmental research which was started in 1986 and initiated field and background research for the First Albertans project. As part of this project, compilation a bibliography of Quaternary geological and palaeoenvironmental studies in the Eastern Slopes was undertaken. Fieldwork was centered in the upper North Saskatchewan valley (with Brian Ronaghan) and in the Grande Prairie area (with Milt Wright). In the Grande Prairie area, information from a local landowner led to the discovery and sampling of a 9,000 year palaeoenvironmental record, containing plentiful plant macrofossils, together with mollusc remains in the lower part of the section. These remains should provide a pollen record spanning most of the Holocene and contribute palaeoenvironmental information for an area about which little is currently known.

In this respect, I should also note that Eugene Gryba has had a long standing interest in the Early Prehistoric Period in western Canada. With the support of the Alberta Historical Resources Foundation, he carried out an important inventory of fluted and other Palaeo-Indian point finds throughout the entire province. One aspect of this research is reported in this volume, and the entire inventory is a valuable contribution to archaeological research for this time period.

In part connected with the First Albertans Project, a scientific exchange programme between the Archaeological Survey of Alberta and the Heilongjiang Provincial Relics Committee has been initiated. Heilongjiang, China is a sister province of Alberta. In 1986, Heilongjiang scientists and officials expressed an interest in exchange visits and sharing of information between archaeologists in both provinces. During May of 1987, Jack Ives and Alwynne Beaudoin travelled to Heilongjiang to visit a variety of sites in the Harbin and QiQiHar areas. While Neolithic and later sites and collections were inspected, greatest attention was devoted to sites ranging in age from 30,000 to 10,000 years B.P. Palaeontological and archaeological sites in this time range contain abundant extinct species, such as mammoth, woolly rhinoceros, large bison and hyaena. Human presence at some localities is evident in the form of stone tools, deliberately modified bone and fragmentary human skeletal material. Scientists in both provinces are keenly interested in exploring the role northern China might have had in the peopling of the New World from northeast Asia.

Heinz Pyszczyk began archaeological investigation of the Fort Vermilion lowlands area in northern Alberta. This initial survey project was aimed at providing baseline information on the prehistory of the region. One of the primary interests of this regional project was the relocation of historical fur trade forts along the Peace River, among them the 1788 North West Company Boyer's Post. Survey and assessment of sites in this region will continue in 1988.

Pyszczyk also directed archaeological investigations near the still-standing 1877 Factor's House at the Hudson's Bay Company's 1877-1878 Fort Dunvegan, as well as an inventory survey of the nineteenth century Buffalo Lake Metis settlement. Both of these projects were undertaken to provide information to aid in the preservation of the two sites.

Michael Forsman continued archaeological investigations at historical Fort Chipewyan. This work, like that of Pyszczyk's, is taking place in support of the Bicentennial of Euro-Canadian settlement in northeastern Alberta. Work was carried out in two areas: the Factor's House, to complete the excavations started there in 1985, and the area of the store. Results of the excavations indicate that both structures date to a new period of construction at the Fort, initiated by Roderick Macfarlane in 1872. The foundations of these features were found to overlie fort remains which date to an even earlier time.

At the University of Calgary, Margaret Kennedy continued her research and analysis of the Morleyville Mission site, as well as doctoral research on southern Alberta's Whiskey Trade era. Richard Garvin completed his Master's thesis on taphonomy. Using bone breakage patterns derived from his study of modern animals, Garvin applied these results to the bone remains from the Hitching Post Ranch site (EiPo-51). Brian Kooyman directed the field school project at the Strathcona Archaeological Centre. The focus of the excavation was a habitation area identified during a previous testing programme. Specific research emphasis was placed on lithic reduction and use wear analyses.

Laurie Milne, who is enrolled in the doctoral programme in the Department of Archaeology at Simon Fraser University, completed analysis and reporting of her work at the Larson site (D1On-3). Located in southeastern Alberta, the Larson site was excavated in 1986. The site is a large campsite displaying Avonlea Phase components dating from A.D. 600 to A.D. 900.

Daryl Fedje and Alison Landals conducted preliminary excavations at the Eclipse and Divide Creek sites in Banff National Park, Alberta. The Eclipse site yielded Late Prehistoric and Palaeo-Indian components. While the Late Prehistoric material consisted of a small amount of non-diagnostic lithic remains and bone dating to c. 200 years B.P., the Palaeo-Indian component produced several thousand lithic items, including tools and stemmed points, and radiocarbon dates of c. 10,000 and 9,800 years B.P.

Daryl Fedje and Joanne McSporran continued excavation at the Divide Creek site. In 1986, this site had produced dates of c. 700 and 1,600 years B.P. Projectile points recovered from their 1987 work are indicative of the Middle Prehistoric Period. This site has been interpreted as a pithouse occupation which is unique for the Eastern Slopes of the Rockies.

Stan Van Dyke undertook excavation at four sites in Jasper National Park, under contract with Environment Canada, Canadian Parks Service. The Devona Cave site yielded an undiagnostic point, bone beads and obsidian, and it dates to c. 4,230 years B.P. Testing at the other sites revealed Late Prehistoric occupation of c. 1,500 years B.P. at the Marrow Point site, compressed stratigraphy and occupation below St. Helens Yn Ash (3,350-3,500 years B.P.) at one of the Pocahontas area sites, and stratified cultural deposits to greater than 13 m below surface at the other site.

Working for Fedirchuk, McCullough and Associates under contract with Alberta Transportation, Glenn Stuart conducted excavations at the Cranford site (DlPb-2), a multi-component campsite on the Oldman River in southern Alberta. Preliminary typological analysis of the material from this ring feature site indicated McKean, Pelican Lake, Besant, Avonlea and Old Women's phase occupations. The site is especially interesting because this is one of the few documented instances of McKean points being found in a ring.

Stuart also conducted excavations at the Wells site (FdOt-9), a stratified, multi-component campsite located near the Battle River in Alberta's east-central parklands. Preliminary results indicate Besant and Old Women's phase occupation, as well as a historical component. For Ethos Consultants, Stuart directed a combined HRIA-mitigation project in the Oldman River Dam development area near Pincher Creek. Several new sites were recorded, and a site with buried rings dating 2,000 to 1,150 years B.P. was excavated.

In closing, I would observe that the level of archaeological activity in Alberta during 1987 remained roughly consistent with previous years: 87 permits were issued, and two were cancelled, leaving a total of 85. Of these, 65 were granted for historical resources impact assessments; 12 were granted for mitigation projects; and eight were devoted to research. As the result of work in 1987, 248 new sites were located, and 47 sites were revisited. CHIN system entries were made for 819 sites from Alberta.

The individuals working for consulting firms included Richard Callaghan (Aresco Limited); Stan Van Dyke and Tom Head (Bison Historical Services Limited); Rebecca Balcom (Environmental Management Associates Limited); John Brumley, Barry Dau and Glenn Stuart (Ethos Consultants); Gloria Fedirchuk, Ed McCullough and Glenn Stuart (Fedirchuk, McCullough and Associates Limited); Bea Loveseth and Brian Reeves (Lifeways of

Canada Limited). Independent consultants included Peter Bobrowsky, Eric Damkjar, Terry Gibson, Eugene Gryba, James Light and Stan Saylor. Research permits were issued to Brian Kooyman of the University of Calgary, Elizabeth Mann of the University of Alberta, and Jack Brink, Michael Forsman, Heinz Pyszczyk, Brian Ronaghan, J. Rod Vickers and Milt Wright of the Archaeological Survey of Alberta.

THE 1987 FIELD SEASON AT HEAD-SMASHED-IN BUFFALO JUMP: AN INTERIM REPORT

By
Jack Brink
and
Bob Dawe
Archaeological Survey of Alberta

Staff from the Archaeological Survey of Alberta returned to Head-Smashed-In Buffalo Jump in the summer of 1987 to continue what has now been a five year field programme of research and mitigative archaeological studies. This work has been in support of the Alberta government's plans to construct a major interpretive centre at Head-Smashed-In (HSI), plans which came to fruition in the summer of 1987. Because of the push to complete the centre, a massive opening ceremonies gala, and the first year of a long-range initiative to run a fully public archaeological project, the actual conduct of field archaeological studies was a decidedly minor part of the 1987 season. Nevertheless, some excavations were undertaken, and the intent of this report is to provide a brief review of the events of the past summer and to point to future goals for the HSI project.

With much fanfare, a Royal couple, a makeshift village of over 40 tipis, a three day native dance ceremony, and about 5,000 tourists, the Head-Smashed-In Interpretive Centre officially opened to the public in July of 1987. The centre contains displays, artifacts and audio-visual presentations pertaining to the themes of Plains ecology, native peoples of the Plains, the buffalo jump, the arrival of Europeans and the science of archaeology. These are presented in a subterranean building which is terraced into the slope of the bedrock cliff a few hundred metres south of the actual HSI kill site. In addition, the site offers special educational programmes, hiking trails, interactive displays, a gift store, a cafeteria, a fully functioning archaeology laboratory and, as of the 1987 season, a daily archaeological project intentionally placed and conducted so as to maximize exposure to and interaction with the visiting public.

Due to the opening of the interpretive centre, excavations conducted at HSI during the 1987 field season were geared towards satisfying the long-term objectives of public interpretation and archaeological research. It was decided that these considerations could be met best by undertaking an excavation of the processing area adjacent to a nearby hiking trail below the kill site (Figure 1). The excavation was planned as the start of what is envisioned as a large, contiguous excavation running over the course of several years. This large exposure will enable a better understanding of the spatial patterning of cultural activities in the processing area associated with the buffalo jump.

This research objective necessitated a tighter control on provenience information than was obtained during previous test excavations. Therefore, it was decided to augment the method used in the 1983-1986 field seasons with the addition of three dimensional piece plotting of lithic materials. Due to the large number of tiny pieces of debitage characteristic of this assemblage, piece plotting was restricted to debitage greater than 1 cm in length; smaller items were bulk bagged for each 10 cm level of a 1 x 1 m unit. The previous years' methodology of mapping the distribution of bone, fire-broken rock (FBR) and features was retained, as was excavation in 10 cm arbitrary levels. The implementation of the piece plotting of lithic artifacts obviated the need for excavating using the 50 square centimetre subquadrants which previously had been our minimum units of provenience (Brink et al. 1985, 1986).

To better facilitate the accurate mapping of the cultural material, we decided to implement a site grid for which all excavations would have a common system of coordinates. This site grid was developed in conjunction with a customized computer program to provide an efficient means of standardizing the mapping and cataloguing of cultural material recovered at the site.

The excavation area exposed during the 1987 field season at Head-Smashed-In consisted of a rectangular pit measuring 2 x 4 m. This area was fully excavated to 40 cm, at which depth no further cultural material was observed, other than that obtained from rodent burrows or cultural features. When this occurred, excavation proceeded until sterile soil was encountered. No stratigraphy was apparent in this area,

Figure 1. Visitors observing the 1987 excavation at Head-Smashed-In Buffalo Jump.

except for the approximately 20 cm thick Ah horizon which caps an essentially sterile, buff-coloured loess. The vast majority of the cultural material was recovered from this topsoil.

Although the results of the excavation have not been fully tabulated, 14,337 pieces of cultural material have been catalogued, including 12,607 lithic artifacts, 1,707 identified faunal elements and 23 ceramic sherds. In addition, approximately 294 kg of fire-broken rock were recovered during the 1987 excavation. The inventory of artifacts and faunal material appears to be similar to that excavated previously in the processing area (Brink et al. 1985, 1986).

Of the lithic artifacts recovered, 331 (2.7%) are tools, 67 (0.5%) are cores, and the remainder (12,209; 96.8%) are pieces of debitage. The culturally diagnostic artifacts are typologically most similar to those of the Old Women's and Avonlea phases; however, both Besant and Pelican Lake material may be present in very small amounts. The lithic inventory is characterized by a bimodal reduction strategy based on the nature of raw material utilized. Fine-grained, isotropic, siliceous materials are rare in the vicinity of Head-Smashed-In, and, although they dominate the tool and debitage classes numerically, they are characteristically represented by worn out or broken small formed tools or by the tiny debitage associated with the final stages of lithic reduction or rejuvenation. Tool manufacture from fine-grained materials is poorly represented in the lithic assemblage; hence, tools of these materials appear to represent a highly curated aspect of the lithic assemblage. Relatively coarse-grained materials, such as quartzite and argillite, are abundant in the vicinity of HSI and are well represented in the assemblage by all stages of the reduction process. These coarse-grained materials are manifest in the tool category as large expedient butchering tools. Seldom are the finer crafted artifacts, such as points or other bifaces, manufactured from these coarse lithic materials. Lithic artifacts of all types frequently show signs of reuse, and the production of serviceable tools is optimized by the bipolar reduction of even very small pieces.

Faunal materials recovered during the 1987 season were similar in most respects to those of the previous seasons. The assemblage is dominated again by badly weathered and highly fragmented bison bone. As of this writing, the non-bison bones have not yet been fully identified; however, it is expected that about 2 to 3 percent of the sample will consist of non-bison material, especially dog/wolf.

Of the 1,707 bison bones identified and catalogued, the majority (n=1,309; 76.7%) are appendicular elements. This is in keeping with previous studies which have indicated a heavy predominance of leg bones in the processing area of the site. While cultural selection of these meat bearing and marrow rich bones is a decided possibility, the poor preservation of the sample could be equally responsible for the bias towards appendicular elements. In other words, minimal soil deposition on the prairie during the past 2,000 years and the consequent extensive weathering of the bone may have served to remove from the sample many of the less durable elements, perhaps leaving the thick leg bone fragments and the small, tough elements, such as phalanges and sesamoids, in higher proportions than was the case during site use. Fully 17.2 percent of the recovered bones could be identified only as long bone fragments. Phalanges and sesamoids make up another 15.6 percent of the sample (see Table 1).

When examining Table 1, it should be kept in mind that many of the axial elements are also fragmentary pieces. Thus, the total of 122 rib items actually represents a great number of small rib body fragments and

Table 1. Summary of the faunal material from DkPj-1, 1987 excavation.

Faunal Group	Number of Items Recovered	Percentage of Total Assemblage
Front leg	345	20.2
Rear leg	317	18.6
Long bone fragment	294	17.2
Phalange/sesamoid	267	15.6
Rib	122	7.1
Pelvis	29	1.7
Skull/teeth/mandible	207	12.1
Vertebrae	84	4.9
Indeterminate	42	2.5
Total	1707	99.9

a few rib heads, but no complete ribs. The same is true of skull and mandible elements. Calculations have not yet been done to determine MNI for this sample. To emphasize the relatively fragmentary nature of the faunal material, the average weight for all of the 1,707 catalogued items is only 46 g. By level, the majority of bones (50.6%) were recovered from level 2. About half that amount came from level 1, and the remainder are from levels 3 and 4. As we have reported in previous publications, the compression of numerous occupational events into a thin soil horizon has produced a mixed record of bison processing over time. Currently, we know of no way to allow temporal separation of different uses of the jump and instead have treated the faunal sample as a whole. It is hoped that the restricted use of this site for bison processing, and apparently no other prehistoric function, should allow the detection of behaviour patterns associated with the processing of mass kills. Analysis of the 1987 fauna and that for subsequent years will concentrate on this effort.

In addition to the artifactual materials, six cultural features were recovered in the 1987 excavation. These include two multiple bone upright features, a large pit feature, two hearths and a thick ash concentration. Such cultural features are consistent with an interpretation of this area as a processing area in which stripping and drying of meat, bone marrow extraction, grease rendering and processing of food for storage were primary activities.

Of particular interest was the large pit feature which was partially exposed in the northwest corner of the excavation (Figure 2). Although unexcavated portions of the feature clearly extend to the north and west, it was evident that we had exposed approximately half or more of the total pit contents. This pit contained 361 faunal elements (NISP), at least 356 (98%) of which appear to be bison. In addition, 8 kg of fire-broken rock were removed from the matrix of the pit. The identifiable faunal elements consisted mainly of the fragmented long bones and associated lower limb bones (231; 64%) and pieces of ribs (27; 7.5%), as would be expected in a pit used to boil grease from bones. This pit feature was considered unusual, however, in that it contained 30 nearly complete vertebrae and several fragmentary bison crania, including seven horn cores, representing at least four individuals, and one largely complete skull near the very bottom (Figure 3). Our interpretation of this pit, based on previous excavations of similar features in the processing area, is that it probably functioned as a boiling pit, but the presence of bison crania and the large number of vertebrae suggests that the fill may be fortuitous rather than in primary association in the pit.

The bone upright features (Figure 4) are again similar in most respects to those discovered during previous seasons at HSI (Brink et al. 1985, 1986). They consist of a number of tightly clustered bones planted vertically in the ground and extending into the sterile subsurface mineral soil. Bison rib body fragments and sections of long bone shafts are the most common elements in the uprights. Because of the extreme amount of rodent burrow disturbance in the prairie soil, we are always cautious in assigning a feature designation to any unusual concentration of artifacts which can be explained by burrowing action. Many upright concentrations of bone are found throughout the course of a season at HSI, but most are dismissed as natural features. This is usually apparent from the dark, disturbed soil which surrounds the bones, especially at the base of the uprights in otherwise light-coloured loess. Obviously, many bones were kicked, placed or fell naturally into burrows which existed at the time the site was occupied. Upright

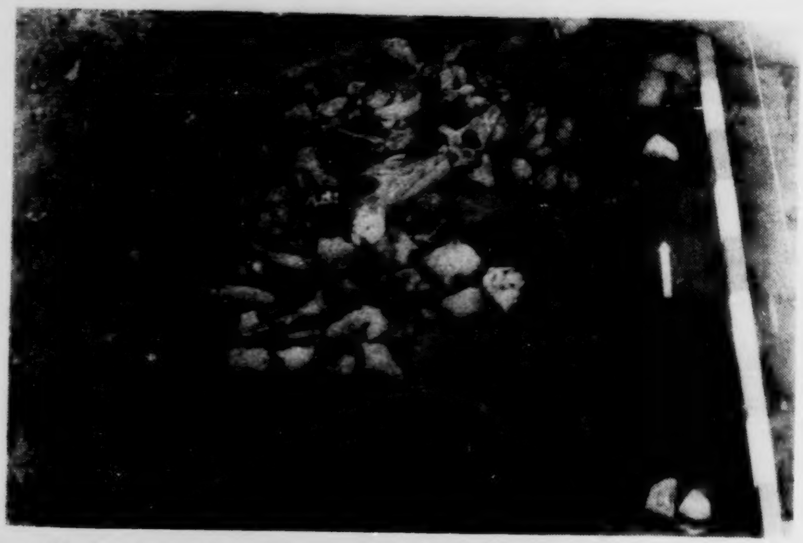

Figure 2. Plan view of a large pit feature at Head-Smashed-In.

Figure 3. Profile view of pit feature.

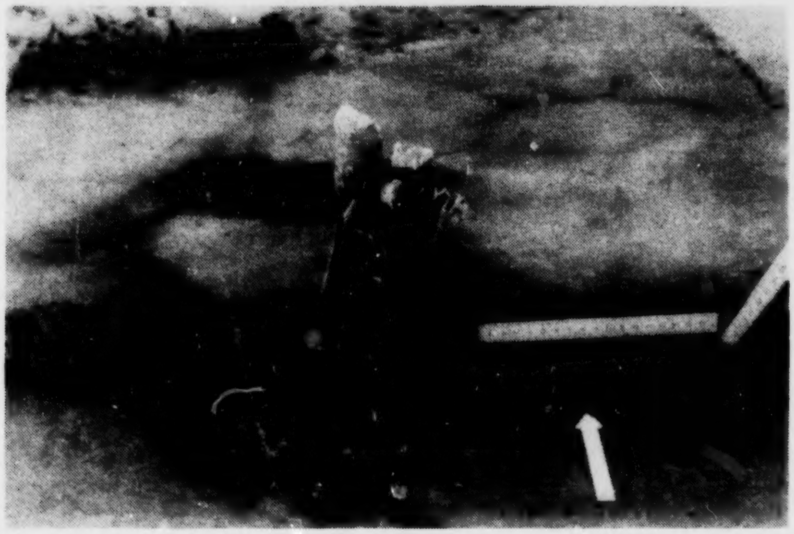

Figure 4. Bone upright feature at Head-Smashed-In.

features are recognized only when it can be demonstrated clearly that the base of the bones extend well into the undisturbed subsoil, as can be seen in Figure 4. The function of the uprights is currently unknown. They may have served as pegs or tie-downs for tipis, as anchors against the wind for meat drying racks, or for other purposes.

Previous research conducted by the Archaeological Survey of Alberta in the processing area indicated a considerable amount of cultural material, particularly microdebitage and small mammal bone, is normally lost using 1/4 inch mesh to screen excavated matrix. It was decided that a sample of this matrix should be retained for water screening to evaluate the nature of data being lost. All excavated matrix from a 1 x 1 m area, representing one eighth of the total area excavation, was retained for this purpose. The preliminary indications of this fine screening suggest that most of the material passing through the screen consists of tiny, unidentifiable fragments of bison bone which were the result of the breakdown of larger pieces by taphonomic and/or cultural factors. Microdebitage and small crumbs of fire-broken rock round out the bulk of the fine-screened fraction, but minimal amounts of small mammal bone, fragmented ceramic sherds, and a few apparently modern seeds and insect parts have also been recovered.

Thus, while the 1987 season was shortened considerably by the midsummer opening of the new interpretive centre, our excavation of two 2 x 2 m units marked the beginning of a proposed long-term excavation programme. This programme will continue to expand the 1987 excavation such that in a few years we hope to have opened one large, contiguous area on the prairie level, possibly totalling several hundred square metres. This will afford the largest detailed view of the remains of bison processing yet obtained from the northern Plains and should add considerably to our knowledge of this communal hunting event.

Equally, if not more important, is the fact that an estimated 50,000 people stopped to visit the archaeological dig this summer, and we expect this number to double next year when a full summer of excavation is planned. The benefits of this exposure, for both the public and the field of archaeology, will not be measured in terms of the number of reports published or professional papers delivered; rather they will be manifest in years to come by the existence of a sympathetic and understanding public who agrees that studying the past is an indispensable part of modern society.

THE STRATHCONA SITE (FjPi-29):
1987 SEASON PRELIMINARY REPORT

By
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The 1987 field season at the Strathcona site (FjPi-29) was designed to expand upon the 1986 excavations and to examine further the probable habitation area located in that portion of the site (Kooyman et al. 1987). An L-shaped excavation of thirty-eight 1 x 1 m units, extending north and east from the 1986 excavation, was completed (see Figure 5). The units were located between 451N and 457N and 155E and 167E on the site-wide grid. As in 1986, excavation was undertaken both by students in the University of Calgary archaeology field school and by volunteers. The 1987 season ran from May 5 to August 27. The two field school sessions went as planned; however, due to restrictions placed on excavation as a result of the July 31 tornado and subsequent clean-up, the volunteer programme was shortened by three weeks.

Four projectile points were recovered during the course of the 1987 excavations. They provide the only means by which to define the occupation period for this portion of the site. Pelican Lake points were found in the upper portions of units 172 and 185; a Hanna point was recovered in the lower half of Unit 186; and a McKean point was found in the lower portion of Unit 197. The projectile points suggest both an early occupation, probably dating to c. 3,000-4,000 years B.P., and a later one, dating to c. 2,000-3,000 years B.P. If McKean, Hanna and Pelican Lake form a continuum, as has been suggested (Reeves 1983:136; cf. Vickers 1986:72-77), these points may represent a continuous, possibly sporadic occupation of this portion of the site. A single radiocarbon date (AECV-426C) was obtained from what appeared to be an undisturbed hearth in the upper portion of Unit 199. Unfortunately, the sample apparently had been contaminated with recent (presumably bomb) C-14 and hence yielded an erroneous date.

The only other information that has some bearing on the question of cultural stratigraphy is the variation in artifact frequency with depth.

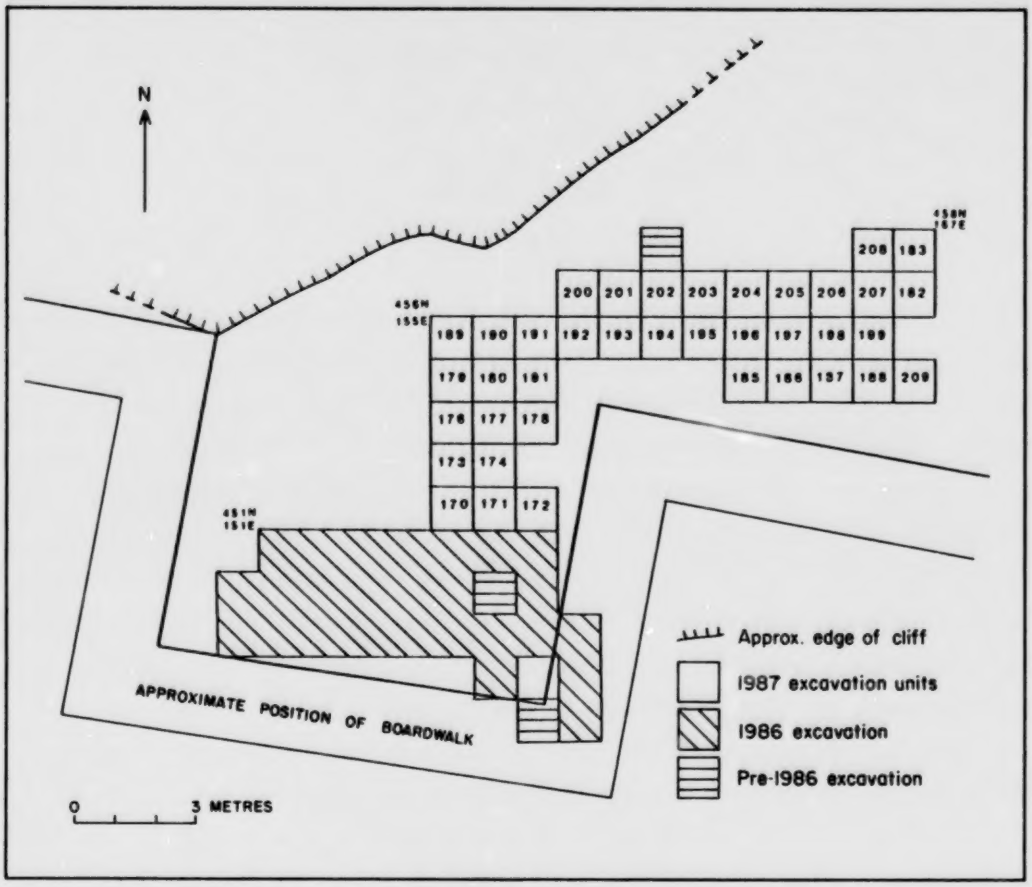

Figure 5. Map of the Strathcona site excavation area.

Five units from the eastern end of the 1987 excavation (units 182, 183, 188, 199 and 205) have obvious bimodal distributions, and another three or four from this area show less marked bimodality. As a result, two more or less discrete periods of occupation may be discernible in this area.

The units showing bimodality are those furthest from the 1986 excavation, where there is also a general decrease in artifact frequency. These units may be located on the periphery of an activity area or areas, probably where activities or occupation extended only occasionally. The 1987 excavation area is adjacent to the cliff edge, and this could be the reason for a less intensive use of the area.

The overall frequency of artifacts in the 1987 excavation area was about half that recovered from the 1986 excavations. For the present discussion, six units, containing 668 pieces (excluding charcoal and seeds), have been selected as a sample of the remains. Two of the units come from the southwestern portion of the excavation (units 171 and 176), two from the central portion (units 185 and 194) and two from the eastern portion (units 182 and 199). The assemblage may be broadly classified as follows: lithic debitage - 78.4 percent, stone tool manufacturing tools (fabricators) - 4.2 percent, tools - 2.5 percent, fire-broken rock (FBR) - 4.9 percent and faunal remains - 9.7 percent. These percentages are similar to those from the 1986 season (Kooyman et al. 1987:24), except that FBR and faunal remains are less frequent (7.4% and 13.1%, respectively, in 1986), and lithic debitage is somewhat more frequent. These figures may indicate that, if this general area is related to habitation as suggested in the 1986 analysis, the 1987 excavation site may be somewhat peripheral, at least to the food preparation locale.

The role of tool refurbishing appears to be much the same in the two excavation areas. Resharpening flakes represent 1 percent of the 1987 sample and 1.2 percent of the 1986 material. As the following figures demonstrate, lithic raw material type frequencies are essentially identical in the 1986 (Kooyman et al. 1987:23) and 1987 assemblages: (a) quartzite - 66 percent in 1986, 67.8 percent in 1987; (b) petrified wood - 12 percent in 1986, 12.1 percent in 1987; (c) chert/chalcedony - 5.5 percent in 1986, 5.7 percent in 1987.

Analysis of lithic reduction for the 1986 remains was based largely on Magne's (1985) work. Research is currently in progress to modify this technique to deal more specifically with quartzite, the most important lithic material found at FjPi-29. As this research is not yet complete, this preliminary report will use Magne's unmodified classification scheme, in which an early stage in lithic reduction is represented by flake striking platforms and shatter dorsal surfaces having only cortex or one flake scar. A middle stage is identified by two such scars, and later stages are represented by pieces having three or more platform or dorsal surface scars. The results of this analysis for the six units used in the present sample are given in Table 2.

The impression given by Table 2 is that the analyses of the shatter and flake debitage contradict each other. The flake analysis shows the early reduction stage to be best represented, while the shatter analysis

Table 2. Lithic reduction stages based on debitage scarring patterns.

	Flakes		Shatter		Flakes and Shatter	
	N	%	N	%	N	%
0-1 Scars	50	44	98	24	148	28
2 Scars	17	15	91	22	108	21
3 Scars	22	19	222	54	244	47
Unclassifiable	24	21	-		24	5
Total	113		411		524	

suggests that the late stage is best represented. However, a second assessment of the role of different reduction stages at the site can be obtained by a tool and flake type classification. Cores, anvils and hammerstones together compose 2.7 percent of the lithic assemblage. Decortication flakes represent 3.3 percent of the lithic assemblage, and bipolar flakes represent 0.1 percent. The presence of these materials indicates that the early stage of lithic reduction was of some importance. Evidence of the late stage of lithic reduction, represented by resharpening flakes (1.3%), sharpening flakes (3.6%) and bifacial reduction flakes (2.4%), indicates that it was also of importance (7.3%). Based on debitage alone, however, the late stage of reduction is about twice as well represented as the early stage. The middle stage of reduction is represented by secondary flakes (0.5%) and thinning/reduction flakes (8%), together suggesting a level of importance similar to that of the late stage of reduction This pattern does not correspond to either of the debitage scarring patterns.

One way to resolve these differences is to consider only the debitage in the conventional flake classification and to suggest, in general accordance with the shatter dorsal scarring analysis, that the late stage of reduction is most important. A similar pattern was seen in the flake classification analysis from the 1986 season (Kooyman et al. 1987:52); however, the general conclusion about reduction stages was that all stages were represented in the remains, probably in approximately equal proportions (Kooyman et al. 1987:60). It is interesting to note that, as in 1987, flake striking platform scarring in the 1986 sample indicated a much greater importance of the initial stage of lithic reduction (Kooyman et al. 1987:53). This might suggest a different reduction strategy for quartzite than for the litnic remains used in Magne's (1985) study.

The material obtained from FjPi-29 during the 1987 field season appears to parallel that recovered in the adjacent 1986 excavation but represents a more peripheral area of occupation. The information from the two seasons' work should enable definition of a clearer picture of the domestic aspect of the FjPi-29 occupation. In combination with experimental work, it should also allow insight into the methods used to work quartzite.

AN ARCHAEOLOGICAL SURVEY
IN THE UPPER NORTH SASKATCHEWAN RIVER VALLEY

By
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and
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INTRODUCTION

As a result of efforts within the Archaeological Survey of Alberta to bring outstanding projects to fruition (Ives 1987), it was decided that the research efforts of staff officers over the next few years would be focussed on a set of problems of regional and international importance. Primary among these is what has become known as the "First Albertans" research initiative. Broadly defined, this initiative seeks to resolve questions relating to the earliest prehistoric occupants of the province, their lifeways and their environment. Because of the magnitude of the question, the vastness of the areas involved and the small amount of concrete information available, it is apparent that resources will have to be assigned on the basis of specific strategies with limited target areas.

The following report constitutes a brief description of the rationale for and results of a small-scale project undertaken by the authors in the upper North Saskatchewan River valley (Figures 6 and 7), during a two week period in the summer of 1987. This survey was considered a pilot study for a search methodology proposed for more widespread use throughout the Eastern Slopes area of western Alberta.

RESEARCH DESIGN

The research proposed for the Eastern Slopes is predicated on the assumption that native Americans first populated the continental interior by moving southwards along the eastern flanks of the Rockies and adjacent areas. This movement is postulated to have occurred after the Late

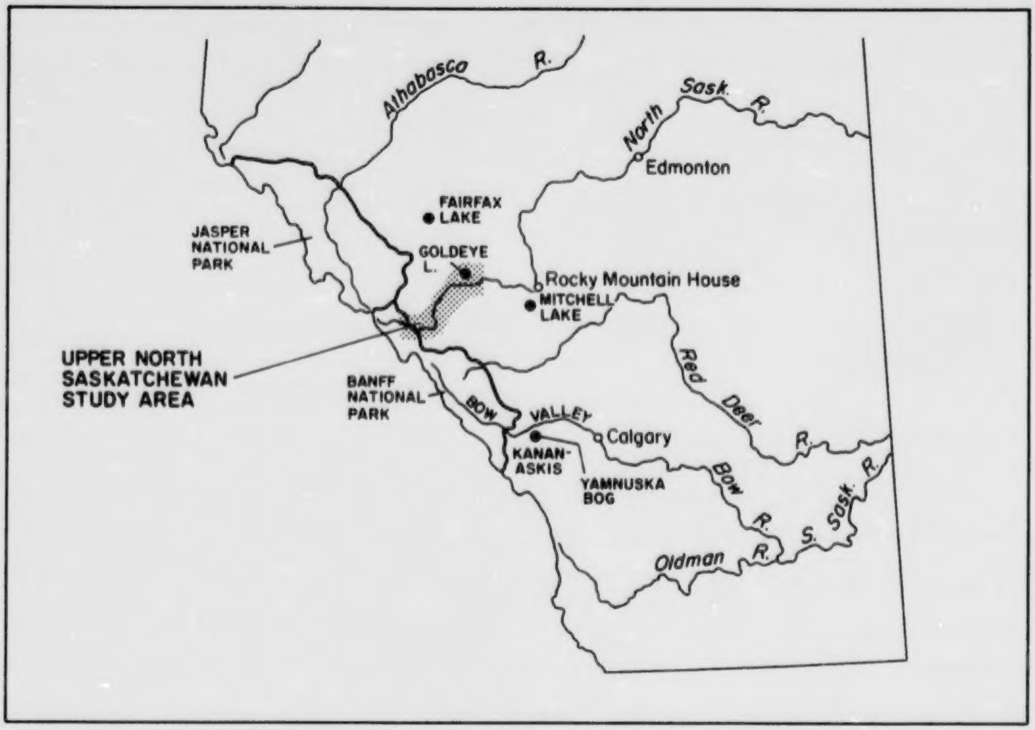

Figure 6. Location of the upper North Saskatchewan River valley study area and other locales mentioned in the text.

Wisconsinan glacial maximum, when Laurentide and Cordilleran ice were not coalescent. The term "ice-free corridor" has been used to describe the area east of the Rockies along which this movement is hypothesized to have occurred (e.g., Reeves 1973). This phrase is misleading in its implications, however, since there is still disagreement as to the character and chronology of Late Quaternary glaciation in this region. For this reason, the term "Western Corridor" will be used in this study.

The issue as to if there was an ice-free corridor extending from Alaska-Yukon to the contiguous United States in the Late Wisconsinan is still contentious. Rutter (1984; Figure 8) has argued that "an ice free corridor existed at least from the Edmonton-Jasper area southward to the International Boundary during Late Wisconsinan time." Rutter (1984) points out that the Quaternary history of the area from Jasper-Hinton northward to the Peace River district is not well known and concedes the possibility that Laurentide and Cordilleran ice may have met in this region. This viewpoint is by no means universally accepted. The recent

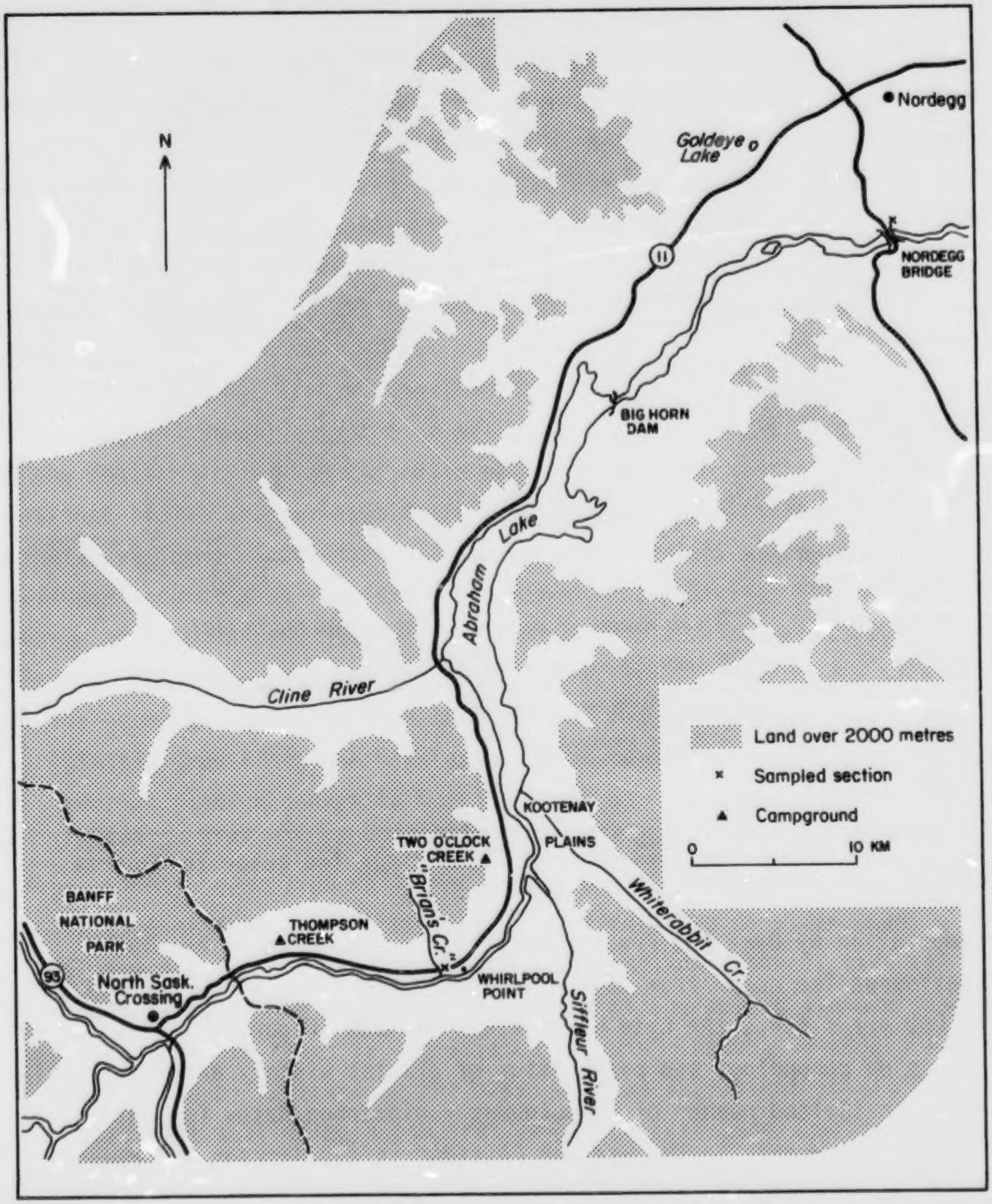

Figure 7. The upper North Saskatchewan River valley study area.

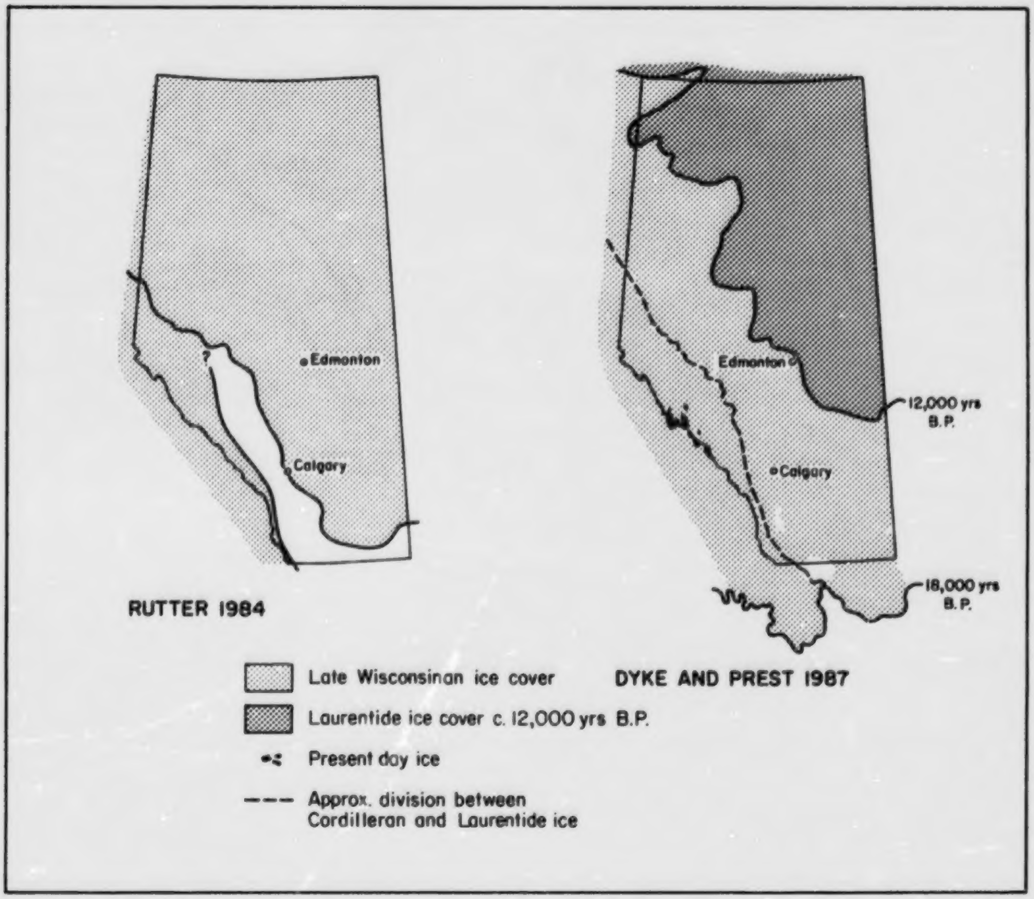
RUTTER 1984
DYKE AND PREST 1987
Edmonton
Calgary
?
12,000 yrs B.P.
18,000 yrs B.P.
Late Wisconsinan ice cover
Laurentide ice cover c. 12,000 yrs B.P.
Present day ice
Approx. division between Cordilleran and Laurentide ice

Figure 8. Interpretations of Late Wisconsinan ice cover in Alberta.

compilation by Dyke and Prest (1987), for example, shows nearly continuous ice cover from the British Columbia-Yukon border to Montana at 18,000 years B.P., the Late Wisconsinan maximum (Figure 8). Much of this debate on chronology and correlation of glacial history and events arises from the limited number of unambiguous radiocarbon dates for Late Wisconsinan events in the Western Corridor (e.g., Jackson and Pawson 1984) and the paucity of dating control for inferred pre-Late Wisconsinan events. This situation has permitted the construction of several alternative scenarios to fit the observed stratigraphic evidence.

The question of the maximum areal extent of Late Wisconsinan ice is not central to the present study, although the timing and character of ice retreat is important. On the basis of the evidence presently available, the constraining dates for migration at either end of the corridor are c. 15,500 years B.P. from Bluefish Caves, Yukon (Morlan 1983:58) and about 11,500 years B.P. from many well-dated Clovis sites in North America, south of the Late Wisconsinan Laurentide ice margin (West 1983:Table 18-1). Thus, the time-frame of most concern in this project is the few millenia prior to 11,500 years B.P. Most reconstructions of ice limits show predominantly ice-free conditions in most of Alberta, and certainly in the critical Western Corridor, by about 12,000 years B.P. (Figure 8). Therefore, the ice cover itself would not have posed a migration barrier at this time.

During retreat from its maximum extent, the Laurentide ice sheet impounded an extensive system of meltwater lakes, such as Glacial Lake Peace (Mathews 1980) and the suite of lakes in north central Alberta (St-Onge 1972). In at least their initial high-level stages, these lakes might have formed a substantial barrier to migration, although new evidence accumulating from the Peace River area indicates that these lake shores might have been preferred camp locations at a somewhat later date (Wright 1988). In addition, recently deglaciated terrain would have been active geomorphologically, due to a lack of vegetation cover and periglacial conditions, particularly in ice-marginal areas.

Pollen studies generally indicate that early postglacial landscapes in Alberta were colonized by open, herbaceous and shrubby vegetation (e.g., Lichti-Federovich 1970; MacDonald 1982). For example, the initial pollen zone at Yamnuska Bog (Figure 6), estimated to be older than 10,000 years B.P., consists of 50 to 84 percent non-arboreal taxa and has been interpreted as "a vegetation dominated by aggressive pioneer species occupying unstable recently deglaciated terrain" (MacDonald 1982:30). Once colonized by vegetation, and provided that sufficient animal food resources were available, a comparatively open landscape should not have provided a major obstacle to migration. In fact, travel may have been easier in these conditions than after much of the area had been colonized by coniferous forest.

From an archaeological perspective, there are no firmly dated sites from this period in the Western Corridor; however, the region does contain some of the earliest known sites in Alberta. The Vermilion Lakes site (EhPv-8) contains, in its deeply buried, lowest cultural horizons, occupations dated around 10,500 years B.P. (Fedje 1986). Its location well inside the mountain front suggests that perhaps even earlier occupations may be present to the east in the Foothills and Front Ranges areas. Fluted points, slightly variant from those characteristic of the earliest firmly dated occupations south of the ice sheets, have also been recovered from this region. The Sibbald Creek site (Gryba 1983), Lake Minnewanka (Christiansen 1971) and the Smoky site (Brink and Dawe 1986) each have produced such points, albeit from disturbed or unstable contexts.

LATE QUATERNARY GLACIAL HISTORY AND PALAEOENVIRONMENTS OF THE UPPER NORTH SASKATCHEWAN RIVER VALLEY

Specific information on the glacial history and landforms of the upper North Saskatchewan River valley region have been presented by McPherson (1970) and Boydell (1978). The surficial geology of the area, at a general level, has been mapped by Bayrock and Reimchen (1980).

McPherson (1970) mapped surficial deposits and landforms of the upper part of the valley, from about the Big Horn Dam upstream, and on this basis inferred the glacial history. Two Cordilleran glacial advances were distinguished within the valley. The older advance, the Big Horn Advance, was undated but reached at least as far as the Big Horn Dam. A later advance, the Main Advance, was inferred to be of Late Wisconsinan age. McPherson (1970:23) was unable to estimate how far downvalley this advance might have reached. This late advance was attributed to Late Wisconsinan on the basis of a radiocarbon date on charcoal of 9330 ± 170 years B.P. (GSC-332) from a section close to North Saskatchewan Crossing (Figure 7) reported by Westgate and Dreimanis (1967). This date provides a minimum limiting date on Late Wisconsinan glaciation in the main valley. Limited Late Wisconsinan ice advances have been suggested from a number of other areas, such as Kananaskis (Jackson 1980; Figure 6). In addition, there are several radiocarbon dates in the Canadian Rockies from areas close to present day ice that tend to support the hypothesis that the main valleys were ice free by at least the early Holocene and have not been re-occupied by ice during the Holocene (Luckman 1988; Luckman and Osborn 1979).

Laurentide and Laurentide/Cordilleran ice interactions have been examined by Boydell (1978) in the Rocky Mountain House area, extending as far west as Range 14, just east of Nordegg. Boydell (1978:13) distinguished deposits associated with four events, three of Rocky Mountain/Cordilleran provenance (Hummingbird/Baseline, Lamoral and Jackfish Creek) and one of Laurentide provenance. The Laurentide event deposited two types of tills: the Sylvan Lake Till is strictly Laurentide in provenance, whereas the Athabasca Till is of mixed Rocky Mountain/Cordilleran/Laurentide provenance and was assumed to be equivalent to the Erratics Train Till in other areas. These various till units were distinguished on the basis of their stratigraphic relationships and lithology, primarily peoble lithologies (Boydell 1978).

The chronology for these events is largely inferential, since none of them has been firmly dated. Evidence for early events associated with the Hummingbird/Baseline Advance was fragmentary and scanty. Despite this, Boydell (1978:33) inferred an Early Wisconsinan age for the Hummingbird/Baseline Advance. The Lamoral and Jackfish Creek Advances were inferred to be Lake Wisconsinan in age (Boydell 1978:29). Boydell (1978) also inferred a Late Wisconsinan age for the equivalent Laurentide Advance which deposited the Athabasca Till; however, work further south in the Kananaskis area (Jackson 1980) suggests an Early Wisconsinan age for the advance associated with this till. In a later review, Rutter (1984:53) ascribed an Early Holocene or Late Wisconsinan age to the Jackfish Creek Advance and correlated it with the Canmore Advance from further south in the Bow River valley (Rutter 1972) and Kananaskis (Jackson 1980) areas. In this reconstruction, the Lamoral and Athabasca Advances are considered to be Early Wisconsinan or Pre-Wisconsinan in age (Rutter 1984:53).

The Late Wisconsinan Jackfish Creek Advance was correlated with McPherson's Main Advance (Boydell 1978:32). Westgate and Dreimanis' (1967) radiocarbon date provides a limiting date for this advance. A limiting date for the deposition of the Sylvan Lake Till was obtained from postcranial bison bone and gastropods recovered from an area of dead ice moraine in the Sylvan Lake Till near Leslieville, east of Rocky Mountain House. These yielded radiocarbon dates of 9670 ± 140 years B.P. and 10,250 ± 165 years B.P., respectively (Boydell 1978:29). From this evidence, Boydell (1978:29) concluded that Laurentide ice, including dead ice, was gone from the Rocky Mountain House area by about 9,600 years B.P. and suggested that the main Laurentide Advance may have ended as early as 13,500-12,500 years B.P.

The area of the Foothills adjacent to the North Saskatchewan River valley has been the focus for several palaeoenvironmental studies. Schweger (1985) has reported a pollen record from Goldeye Lake near Nordegg (Figure 6). A series of radiocarbon dates extending to 23,600 years B.P. suggested that the record spanned much of the Late Wisconsinan and Holocene. The basal pollen zone at Goldeye Lake, with an inferred age of 23,600-15,000 years B.P., was interpreted as "a very sparse tundra vegetation, and severe cold arid climate" (Schweger 1985:55). The succeeding zone (inferred age - 15,500-11,400 years B.P.) was characterized by increased amounts of Salix and Ruppia pollen, associated with increased plant cover and a warmer, more arid climate. This was followed by a brief period (c. 11,400-10,800 years B.P.) with an assemblage dominated by Betula and Populus, which Schweger (1985:55) interpreted as the appearance of "a pioneering parkland or forest type vegetation." Increased amounts of Picea pollen between 10,800 and 7,800 years B.P. marked the establishment of boreal forest, with Pinus pollen dominating the assemblage from 7,800 years B.P. to the present (Schweger 1985:55).

For the area further north, Kvill (1984) and Schweger et al. (1981) have discussed a palaeoenvironmental record from Fairfax Lake (Figure 6). The basal date from this lake is 11,225 ± 120 years B.P. (S-1706; Kvill 1984:145). The lower part of the record, below the radiocarbon date but above the silty clay/organic clay contact, contained a pollen assemblage dominated by Artemisia (c. 40%), with lesser amounts of Salix and Betula, and only minor amounts (c. 10% or less) of Picea and Pinus (Schweger et al. 1981:Figure 2). Schweger et al. (1981:50) suggested that this might be derived from treeless, tundra-like vegetation of an area dominated by a periglacial climate, while acknowledging the alternative explanation that the assemblage was derived from a pioneering vegetation on newly deglaciated terrain.

Palaeoenvironmental studies are presently underway at Mitchell and Stubel lakes (Mandryk n.d.). The lower part of the Mitchell Lake core has yielded an AMS date of 17,960 ± 160 years B.P. (TO-574; Schweger and Hickman 1988). This date is derived from mollusca periostracum and thus is not vulnerable to the problems of coal contamination that have plagued radiocarbon dates from this area (Schweger, personal communication 1988).

Additional chronological control for Holocene records in the upper North Saskatchewan River valley is provided by a series of three tephras. These were originally identified from North Saskatchewan Crossing (Westgate and Dreimanis 1967). They comprise Mazama tephra, dated at about 6,800 years B.P. (Bacon 1983:150), St. Helens Y, dated at c. 3,400 years B.P. (Luckman et al. 1986; Mullineaux et al. 1975), and Bridge River tephra, dated at c. 2,350 years B.P. (Mathewes and Westgate 1980). Since their original identification by Westgate and Dreimanis (1967), tephra occurrences, particularly the presence of Mazama tephra which has the most widespread distribution, have been reported from many localities in the mountains. For example, all three tephras have also been reported from the Sunwapta Pass area not far from the present-day Athabasca Glacier (Beaudoin 1984; Bowyer 1977).

These data concerning glacial history and palaeoenvironments suggest that the latter phase of the Late Wisconsinan was probably a time of restricted ice activity in the upper North Saskatchewan Valley area. Furthermore, even if significant amounts of ice or meltwater were present within the main valleys themselves, palaeoenvironmental information suggests that vegetated landscapes were present, at least in the Foothills. These might have been able to support adequate numbers of game animals to allow human residence on a more than strictly transitory basis. Consequently, site locations may have been chosen on the basis of resource exploitation decisions, rather than simply ease of travel, and may have resulted in larger, more archaeologically visible sites.

CRITERIA FOR THE SELECTION OF STUDY AREAS

In summary, the upper North Saskatchewan River valley was selected as the region in which to conduct the 1987 pilot study for the following specific reasons:

1. Radiocarbon dates, specifically the 9330 ± 170 years B.P. (GSC-332; Westgate and Dreimanis 1967) date from an upvalley location, show

that the Cordilleran ice was well within the mountains by the early Holocene. Thus, the main valley has been ice free at least since the early Holocene.

2. The Goldeye Lake pollen record (Schweger 1985) near Nordegg and the recently obtained radiocarbon date from Mitchell Lake suggest that ice-free conditions and vegetated landscapes probably occurred in the Foothills area from at least about 18,000 years B.P.
3. The occurrence of three tephras in the area provides potentially good additional chronostratigraphic control for any Holocene records found.
4. The Kootenay Plains area was used regularly by native groups in historical times, as reported by Alexander Henry in 1812 (Coues 1897), and is still a locus for native activities. These traditional use patterns may have considerable time depth, suggesting that the valley may have been a perennial use area in prehistoric times.
5. The survey of part of the valley prior to construction of the Big Horn Dam and David Thompson Highway and the creation of Abraham Lake found numerous archaeological sites, mainly dating from Middle and Late Prehistoric times. On the basis of known site densities, there appeared to be good potential for finding earlier sites in this area (Reeves 1972).
6. Attention was focussed on the main river valley because it represents a major travel corridor, providing access into the mountains, thus allowing exploitation of the resources of a range of environments. In addition, the study area is constrained by topography, and the choice of suitable habitation sites is more limited, possibly resulting in archaeologically more visible accumulations in regularly revisited locations.

The presence of a man-made lake in the west central part of the study area was not regarded as a severe constraint on the study. Similar conditions may have occurred during glacial recession when meltwater would have been abundant in the main valley, although there is no evidence for large proglacial lakes in the upper valley. As a corollary, it was expected that older archaeological sites might be located at significantly higher elevations than relatively recent sites and that older sites were unlikely on the modern floodplain.

Within this specific study area, it was necessary to delimit a series of examination locales. The 1987 field project was viewed as an opportunity to test and refine a research design that had been developed using landscape analogues to guide the search strategy. Since similar research designs probably will be employed in subsequent studies in this project, it will be described in some detail here.

It was reasoned that similar site selection criteria may have been used for the very early sites sought in this study as were used for the earliest, presently known sites in the Eastern Slopes of Alberta. In this context, there are six sites within the Eastern Slopes region that may be taken as models. The main characteristics of these sites are listed in Table 3. The Vermilion Lakes site provides perhaps the most promising analogy, given its deep burial, good stratification and excellent preservation of cultural and faunal remains. Its location on a well-drained, south-facing alluvial fan formed the main analogy for the present study. Sibbald Creek analogues were also considered promising.

The landform associations of these earliest known sites were examined, and analogous landforms within the study area were identified on maps to form a sample for possible field examination. A series of air-photos of the main valley were also examined and allowed the possible site locations to be further constrained.

METHODOLOGY

Field studies in 1987 began with a helicopter overflight (courtesy of the Alberta Forest Service) of the study area. Several access problems were identified, and selected landforms were eliminated because of recent depositional activity. In-field examination of the area took place from July 1st to July 10th, 1987, by a crew of three to five persons. The great extent of the study area, the large size of some landforms, and the considerable depth of sediments on them meant that only cursory examination of many locales was possible. Inspection concentrated on visual examination of natural exposures created by road cuts, gravel tests and fluvial activity. Supplementary shovel testing was employed on a limited basis. Because of the number and size of the landforms, a systematic search of all possible locales that met the

Table 3. The early Holocene archaeological sites in the Eastern Slopes area used in setting up the research design.

Site	Estimated Age	Landforms	Location	Aspect	Drainage, Slope	References
Vermilion Lakes EhPv-8	10,500 - 11,000 (Radiocarbon dates)	Alluvial fan	Within major valley, within mountain front	South	Well-drained, sloping	Fedje 1986
Sibbald Creek EgPr-2	Unknown (Fluted points)	High outwash/ kame terrace	Overlooking broad flat valley, suitable for game	South	Well-drained, level	Gryba 1983
Pink Mountain HhRr-1	Unknown (Fluted points)	Glacial lake shore	Ridge overlooking small drainage basin	All directions	Well-drained	Wilson 1986
Smoky GaQs-1	Unknown (Fluted points)	High outwash/ kame terrace	Within major valley	Southeast	Well-drained, level	Brink and Dawe 1986
Eclipse EhPv-14	?Hell Gap (c. 10,000)	Moderately high terrace	Within major valley, within mountain front	South	Well-drained, level	Fedje 1987b

research criteria was not possible. Search was concentrated in those locales where good sections were available and which were readily accessible. This meant that the search was concentrated on the north side of the valley where access was provided by the David Thompson Highway (Highway 11; Figure 7). With the exception of areas around the confluence of Whiterabbit Creek with the North Saskatchewan River, the south side of the valley was not examined in the field. This search restriction was not felt to be a problem because analysis of the earliest known sites (Table 3) showed that most are on south-facing slopes.

Later in the season, two people returned to the area to conduct backhoe tests at two promising locations that had revealed deeply buried surfaces, tephras and dateable materials. Stratigraphy was examined and several samples for radiocarbon analysis were collected.

RESULTS

The landforms examined during this field season can be divided into several types: alluvial fans, terraces and bedrock ridges. For the purposes of this study, the alluvial fans were subdivided into three types: recently active fans, paraglacial fans* and confluence fans.

Prefield air-photo examination and the helicopter overflight had confirmed that many fans along the north valley side had been recently active and are generally associated with small, ephemeral streams in steep, bedrock basins, similar to those described by Desloges and Gardner (1984) or the debris-flow fans described by Kostaschuk et al. (1987). Many of these fans occur along the north shores of Abraham Lake, where steep bedrock slopes are close to the lake. In some cases, the lower parts of these fans are being eroded by wave action on Abraham Lake. These fans often have quite steep surfaces, and the surface debris is often coarse and blocky. Because of recent deposition, few buried surfaces were observed. Although older sediments may occur in these fans, they are likely to be quite deeply buried. These fans do not appear to provide suitable habitable surfaces.

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*Paraglacial deposition occurs during and soon after deglaciation when large quantities of meltwater and unstable, unconsolidated debris are available. The term was first used by Ryder (Church and Ryder 1972; Ryder 1971a, 1971b).

Paraglacial alluvial fans, in which the majority of the deposition occurred by the early Holocene, were examined along the north valley side. These fans are generally well vegetated, mainly by coniferous forest, particularly on their lower slopes, and appear to be associated with somewhat larger drainage basins. One of these fans, informally named the "Brian's Creek" fan, was examined in some detail. It occurs on the north valley side, downvalley from the Banff park boundary (Figure 7). Sediments were exposed in a stream-cut associated with highway drainage, at an elevation of approximately 1370 masl. The section consists of a complex sequence of deposits representing debris-flow events, intercalated with tephras and charcoal layers (Figure 9). Two probable tephra layers were exposed in this section. On the basis of stratigraphy, an upper layer (c. 30-33 cm depth) is likely to be Bridge River tephra, whereas the lowermost layer (c. 215-218 cm depth) may be Mazama. Several charcoal layers occurred in this section. In some cases (e.g., around 130 cm and 240 cm depth), the charcoal layers were underlain by reddish-coloured, "burnt" soil horizons. Similar observations of pyrogenic soil horizons, albeit of post-Mazama age, have been made by Dormaar and Lutwick (1975) in the North Saskatchewan River valley. This section appears to be similar to paraglacial fan deposits from Jasper National Park (Bowyer 1977). McPherson and Hirst (1972) have reported on the sediments of the coalescent Two O'Clock Creek and Bridge Creek fans, downvalley from this location (Figure 7). They reported Bridge River tephra from near-surface deposits, indicating that most of the accumulation on these fans also occurred prior to about 2,350 years B.P.

Confluence fans are associated with Whiterabbit Creek and Siffleur River where they enter the main North Saskatchewan River valley. Deposition on these fans is dominated at present by sediments brought down by the rivers flowing across them. These are fluvial fans as defined by Kostaschuk et al. (1987). During the course of the fieldwork, Whiterabbit Creek fan was examined. The lower slopes of this fan were colonized by open vegetation, and there was evidence of recent deposition. The surface of the fan revealed the remnants of numerous

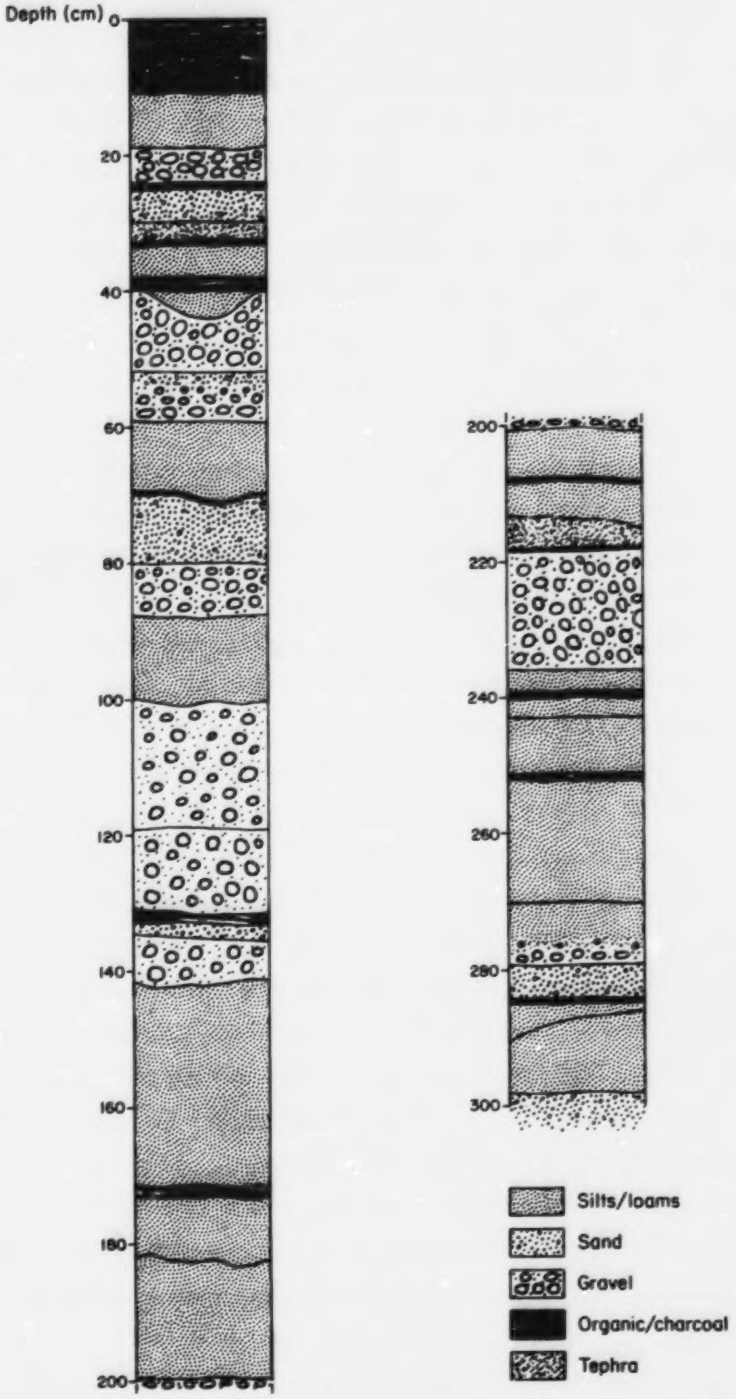

Figure 9. Schematic diagram showing generalized stratigraphy at the "Brian's Creek" section.

channels. Sections cut in the edge of the fan by the North Saskatchewan River revealed thick accumulations of silt, some of which may be associated with recent river overbank deposits rather than deposition on the fan itself. Again, although older deposits may occur on these fans, they are likely to be deeply buried. The remains of several recent sundance lodges were found on the Whiterabbit Creek fan, confirming the importance of this area as a locus of native activities.

A possible moraine near the Thompson Creek Campground (Figure 7) was also examined. Shovel tests revealed only shallow (c. 30 cm), silty deposits overlying a gravelly diamicton. Although the surficial material was silty in texture, no discrete tephra layers were identified. No archaeological materials were found.

Both the bedrock ridges and higher terraces generally have little or no sediment build-up on their surfaces. Adequate assessment of select locales was conducted either visually or with shallow shovel testing. These locations proved to be sterile.

Near the Cline River junction (Figure 7), where Bayrock and Reimchen (1980) and McPherson (1970) identified an area of Cordilleran till adjacent to a meltwater channel, a single, previously unidentified prehistoric site was found on a ridge about 20 m above the present valley floor. It consisted of a small lithic scatter of unknown age exposed along a footpath.

Where the North Saskatchewan River is crossed by a footbridge, about 2 km south of the Two O'Clock Creek Campground, terraces on the east bank of the river were examined. The terraces are estimated to be about 5 m above the present river level and have been subjected to considerable aeolian deposition. Aeolian deposition appears to be ongoing. McPherson (1970) identified a small area of dunes in this vicinity. These terraces presented a relatively continuous level surface which would have been suitable for occupation. Two additional small lithic scatter sites were identified in blowouts. Otherwise, examination of sections in these terraces exposed along the eroding river edge suggested that they were of insufficient age to contain the kinds of cultural materials sought.

Terraces adjacent to the North Saskatchewan River at the eastern end of the project area were also examined. At the Forestry Trunk Road crossing the North Saskatchewan River near Nordegg, a terrace, complete with a magnificent view of the valley and a previously identified archaeological site (FcQa-6), was examined (Figure 7).

The North Saskatchewan River has cut down through glacio-fluvial deposits ("valley train"; Bayrock and Reimchen 1980) leaving comparatively large remnants as terraces. These are particularly noticeable between Nordegg Bridge and the Big Horn Dam. The Nordegg Bridge section (Figure 7) is situated at the downstream side of one of these terraces, at an elevation of approximately 1190 masl, an estimated 25 m above the present river channel.

The section* consists of a series of fluvial sediments, overlain by aeolian sediments (Figure 10). The lower part of the section, particularly beneath about 340 cm depth, consists primarily of gravels with occasional silt and sand layers which become more frequent between about 206-340 cm depth. The upper part of the section (0-c. 206 cm depth) is predominantly silt and is probably aeolian in origin. Further evidence of aeolian activity is seen on the surface of the terrace adjacent to the road, where small dunes occur.

The section also contains light-coloured, silty layers which are probably tephra. These occur between about 75 and 76 cm depth (?Bridge River), between 110 and 111 cm depth (?St Helens set Y) and between 196 and 204 cm depth (?Mazama). The contact between the ?Mazama tephra and the underlying silt layer is convoluted, suggesting that the tephra was deposited onto wet sediments.

The section also appears to record fire history through a series of charcoal and burnt layers, for instance, around 103-110 cm depth, 147-156 cm depth and 317-318 cm depth (Figure 10). However, because of the occurrence of coal around Nordegg, a former coal-mining community, it was felt that charcoal layers could be coal-contaminated and thus unreliable for radiocarbon dating. To test this, coal/charcoal fragments were handpicked from the lower part of the section (c. 255-265 cm depth) and submitted for radiocarbon dating to the Radiocarbon and Tritium Laboratory, Alberta Environmental Centre, Vegreville. The material was

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*Subsequent to the summer field work, it was discovered that Dr. R.B. Rains (Department of Geography, University of Alberta) has also sampled a section at Nordegg Bridge. However, as far was we are aware, there is no previously published material from this location.

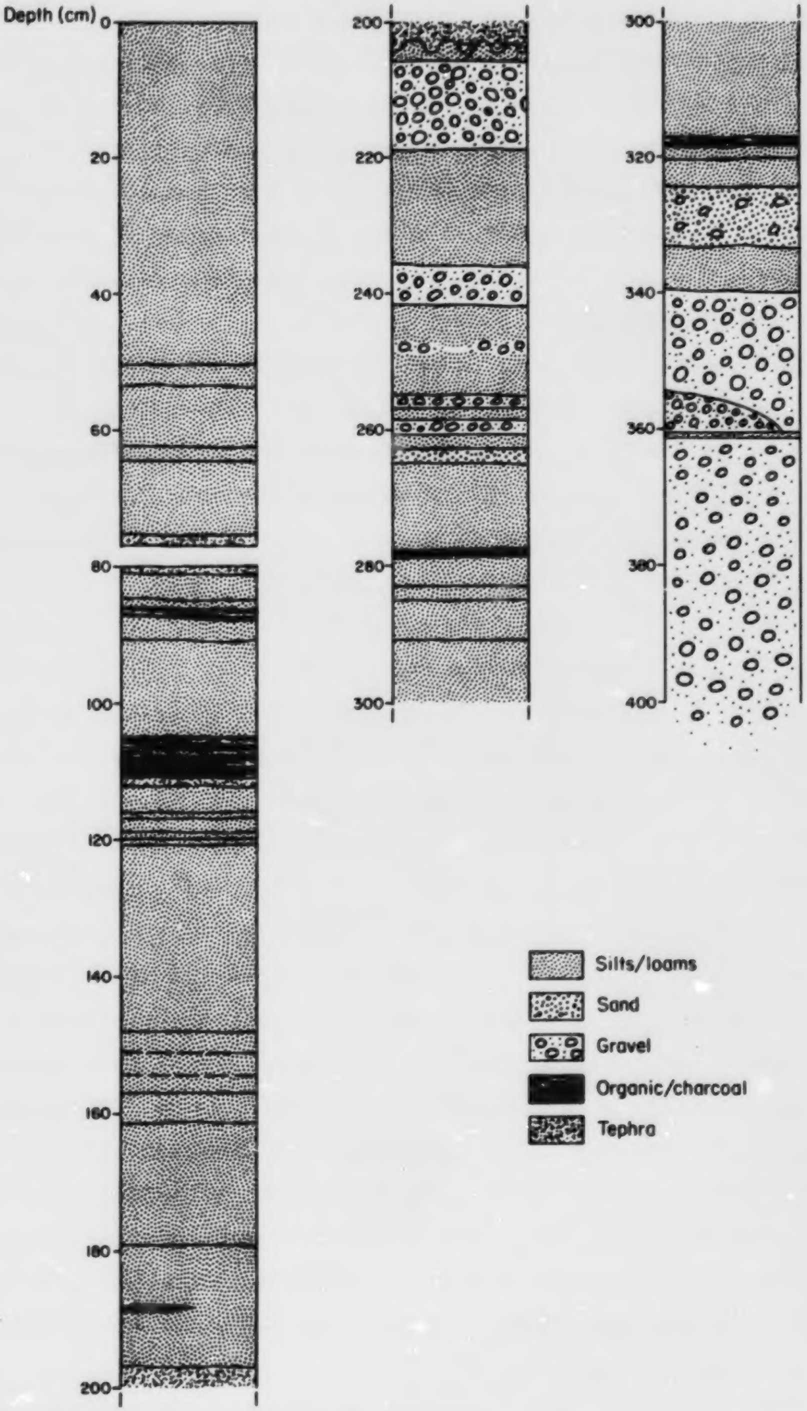

Figure 10. Schematic diagram showing generalized stratigraphy at the Nordegg Bridge section.

beyond the range of conventional radiocarbon dating, yielding a date of >40,000 years B.P. Obviously, this material was coal-contaminated, and this date has no chronostratigraphic implication. According to Dr. L.D. Arnold (personal communication 1987), there is no reliable method for separating finely divided coal from charcoal in the preparation of a sample for radiocarbon dating. Although complete bedrock geology map coverage is not available, Mesozoic coal-bearing deposits outcrop in the North Saskatchewan River valley from the northern part of Abraham Lake downstream (Douglas 1956; Mountjoy and Price 1975a, 1975b). Although, in many cases, this bedrock is masked by surficial deposits, it is sometimes exposed at the surface, as in the Big Horn River valley. Thus, it would be wise to radiocarbon date archaeological materials found downstream from Abraham Lake by materials other than "charcoal."

Archaeological materials (lithic artifacts and small bone fragments) were identified in situ in the upper levels of the Nordegg Bridge section but did not appear to extend below the ash layers. For this reason, they were believed to be relatively recent in origin.

Later backhoe work conducted at the Nordegg Bridge terrace and at the "Brian's Creek" fan revealed extensive Holocene depositional records. On the "Brian's Creek" fan, charcoal recovered from beneath the lower tephra (c. 4.25 m depth) yielded a radiocarbon date of 6720 ± 150 years B.P. (AECV-463; C-13 corrected date). Despite their suitability for prehistoric occupation, no cultural material was recovered from either of these locations. However, the work undertaken in recording and sampling these sections provided useful information on Holocene depositional sequences in the region, and the features themselves are still considered to be good examples of the types of locales which may yield early cultural materials.

DISCUSSION

The upper North Saskatchewan River valley project was designed as a small-scale test of a search strategy for archaeological sites of early Holocene or Late Wisconsinan age. No sites of this type were encountered. Both this result and the relative paucity of sites of more recent age require some discussion. The pre-inundation survey of the

Lake Abraham section of the river valley had identified considerable numbers of sites on the now flooded lower terraces (Reeves 1972). It is suspected that the few sites identified in the present study represent either transitory stops on the way to some inundated sites in the Kootenay Plains area or task-oriented sites associated with these larger sites. It does not appear that the areas examined were subject to intensive exploitation during later Holocene times.

The difficulties in finding relatively ancient sites can be attributed to several possible causes. Primary among these are logistical factors, such as the large size of the study area, the few people in the field crew, and the limited time available for the field study. Secondly, the depth of recent deposition on some of the landforms in the area was unexpected and suggests that older archaeological materials are likely to be more deeply buried than anticipated. Several of the most promising features were inaccessible to the heavy equipment necessary for deep testing and are so large that site discovery will be largely serendipitous. We feel that these locations still offer some of the best possibilities for early sites in this area. The lack of cultural materials in the two locations deep tested is disappointing but understandable, given the expected limited distribution of sites of this age and the relatively restricted investigation conducted to date.

For this study, we employed analogies from known site locations in the Bow River valley, considerably south of the project area. In retrospect, we still feel that this was appropriate as it allowed selection of specific landforms within a very large area. Generally, the landscapes in the North Saskatchewan and Bow river valleys are sufficiently similar that we believe promising locations were not overlooked by adopting this methodology. Two very likely locations were assessed by this programme, and several others were identified on which appropriate deep testing could not be employed. Elsewhere, deposition factors suggested that the possibility of site burial and preservation were limited. If the First Albertans "needle" has not yet been found in the North Saskatchewan River valley "haystack," it is more a matter of circumstance than use of an inappropriate search strategy.

ACKNOWLEDGEMENTS

The entire field experience was greatly enhanced by the enthusiastic participation of a gung-ho field crew, comprising John Priegert, Carol Rushworth and Alan Gray. Dr. T.F. Morris is thanked for discussion during a later field visit to the Nordegg Bridge area. Dr. R.B. Bains is thanked for discussion of the Nordegg Bridge section.

FhPm-1: AN OCCURRENCE OF "CHARLIE LAKE" TYPE FLUTED POINTS NEAR THORSBY, ALBERTA

By

Eugene M. Gryba

A 1987 inventory of fluted point occurrences in Alberta, funded by the Alberta Historical Resources Foundation (Gryba 1988), brought to light eight possible Palaeo-Indian points (Figures 11 and 12) recovered from contiguous cultivated fields near Thorsby, Alberta (site FhPm-1). They display formal and technological similarities to the poorly known Goshen Complex from Hell Gap (Irwin-Williams et al. 1973:46) and to the multiple fluted specimen found at the Charlie Lake Cave site in northeastern British Columbia (Fladmark and Gilbert 1983).

Site FhPm-1 extends along the crest of a locally prominent ridge situated about 2 km north of Thorsby. Located about 10 km south of the North Saskatchewan River, this ridge forms a height of land approximately 1 km in width, which separates Weed Creek from Strawberry Creek. The ridge rises quite abruptly for 4 to 6 m above the surrounding plain along the northwestern edge and then slopes gently to the southeast. Much of the terrain, except for bluffs of aspen on the uplands and stands of aspen and spruce within Weed Creek valley, has been brought under cultivation. The presence of stones in the cultivated fields indicates that glacial till occurs near the surface. Except for several local depressions, the crest of the ridge is fairly even.

Three specimens (Figure 12a, b and e) are reported to have been found in LSD 5 of Section 23, Township 49, Range 1, W5M. Five other fluted points (Figure 12c, d, f, g and h) were discovered north of the fence line in the northwest quarter of Section 23, on the west ridge of a large depression. This relatively large sample of fluted points may suggest some duration of site use, occupation by a relatively large social group, or repeated seasonal occupation by early Palaeo-Indian groups.

Selected quantitative and qualitative data on the eight Palaeo-Indian points from FhPm-1 and the Charlie Lake specimen are summarized in Table 4. The Charlie Lake specimen (Figure 13) is a resharpened example manufactured from a dark grey chert. On both obverse and reverse

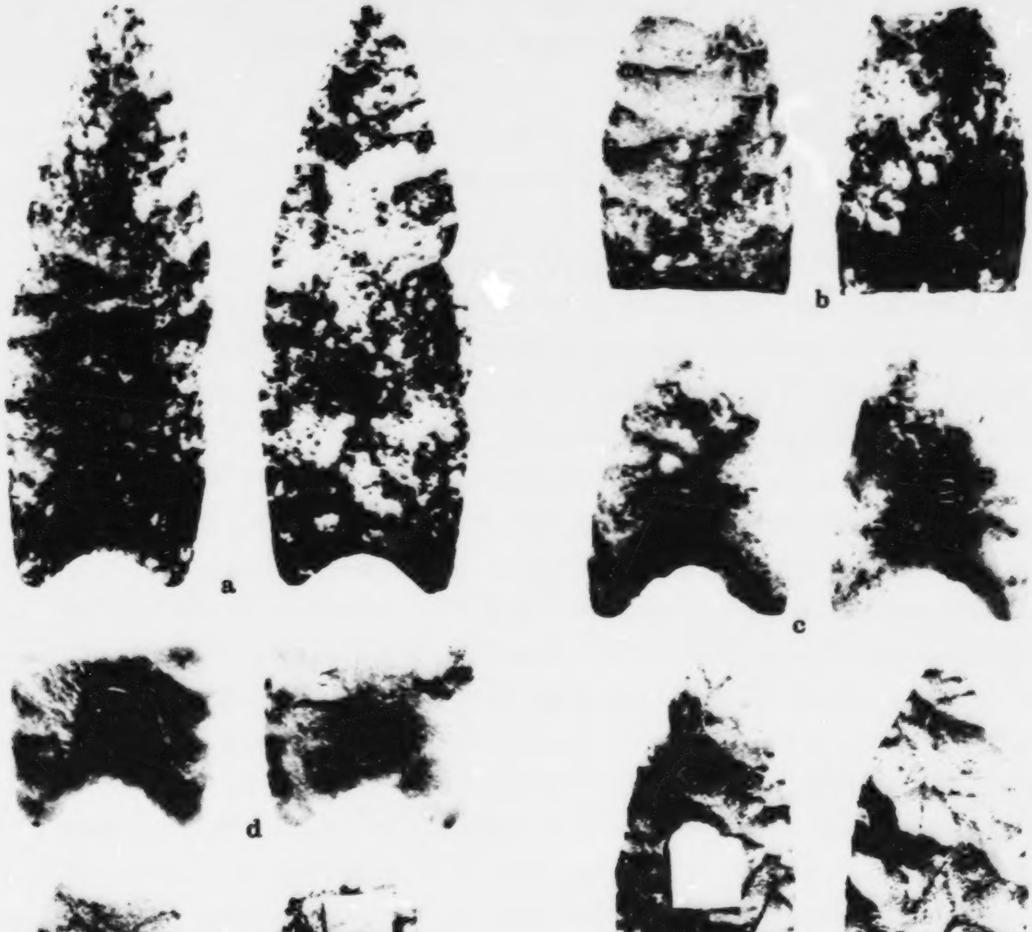

Figure 11. Basally thinned Palaeo-Indian points from FhPm-1.

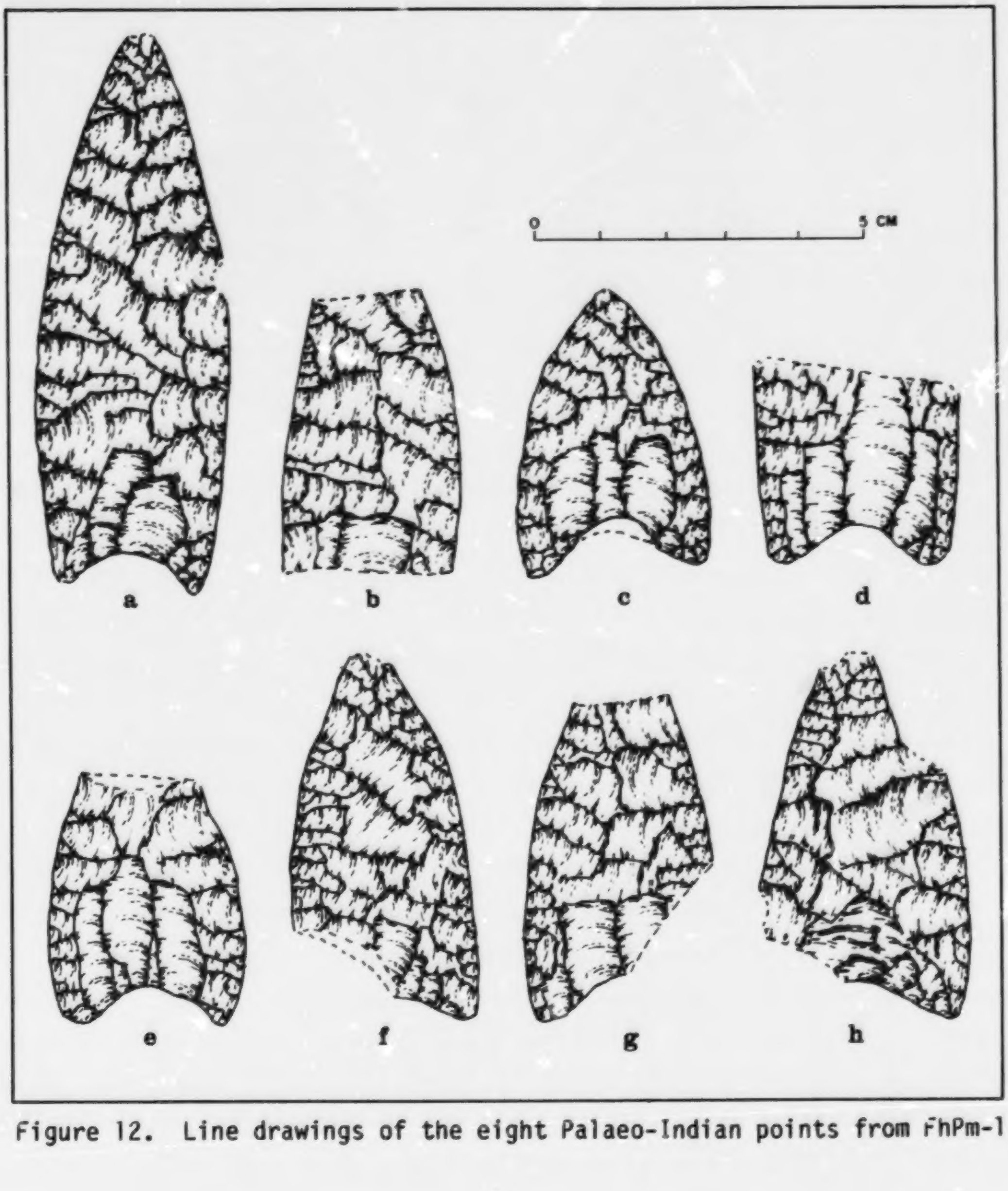

Figure 12. Line drawings of the eight Palaeo-Indian points from FhPm-1.

Table 4. Qualitative and quantitative (mm) attributes of the eight basally thinned points from FhPm-1 and the single specimen from Charlie Lake.

Figure	Material	Length	Width	Thickness	Depth of Basal Indentation	Lateral Smoothing	Basal Smoothing	Multiple Fluting (O)	Multiple Fluting (R)	Width Largest Thinning Flake	Length Largest Thinning Flake
FhPm-1:											
11a	mudstone	85.0	39.5	5.7	4.5	+	+	+	+	6.2	16.5
11b	mudstone	42.0*	28.1	5.3	?	+	?	+	?	7.1	10.5*
11c	quartzite	41.5	29.5	5.2	7.4	+	+	+	-	13.8	13.2
11d	quartzite	30.1*	31.0	5.8*	6.0	+	+	-	+	9.5	21.1*
11e	mudstone	37.1*	29.2	4.9	5.2	+	+	+	+	7.8	18.0
11f	siltstone	55.5*	26.6	6.1	4.1	+	+	+	-	8.0	10.0
11g	quartzite	47.8*	29.5*	5.2	5.2	+	+	+	+	8.0	12.0
11h	quartzite	53.0*	31.0	5.0	4.5	+	+	-	-	-	-
Charlie Lake:											
13	chert	39.3	28.4	5.6	6.0	+	-	+	+	?	20.0

Key: (O) obverse aspect, (R) reverse aspect, + present, - absent, ? unknown, * measure from incomplete specimen

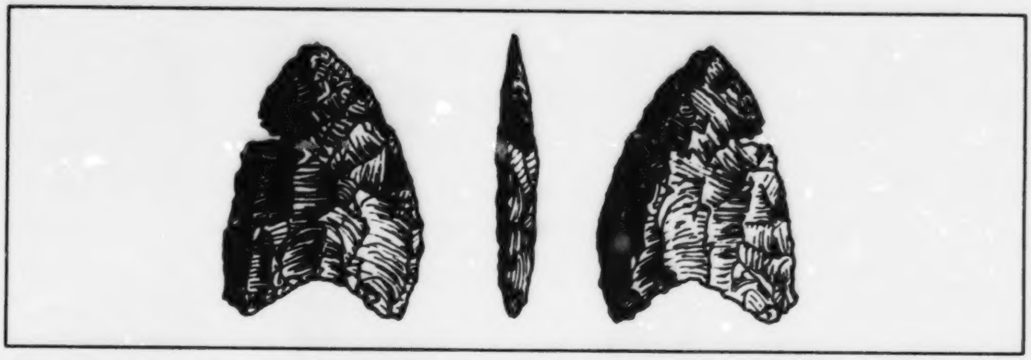

Figure 13. Line drawings of the multiple fluted point from Charlie Lake (from Fladmark 1986:Plate 3).

aspects, a second generation of base thinning flakes partially obliterates an earlier series (Fladmark and Gilbert 1983:2). The points from FhPm-1 display some similarity in base configuration, width and basal thinning. Both long, narrow (Figure 12a and b) and short (Figure 12f and h) lanceolate forms were manufactured, likely reflecting the availability of local lithic material. The abrupt convergence of the blade from the base on three examples (Figure 12c, e and g) is probably due to resharpening. By comparison, five points recovered from the surface of FkPf-50, a multi-component site near Bruderheim, also display multiple basal thinning but differ from the FnPm-1 specimens in their rather broad size range, particularly in width (Figure 14).

Chronologically, the basally thinned points from FhPm-1 may fit within the latter half of the Fluted Point Tradition. Radiocarbon dates obtained on bison remains believed to have been recovered from the same level as the multiple fluted point at Charlie Lake averaged 10,487 years B.P. (Fladmark and Gilbert 1983:7). In Alberta, basally thinned points of similar shape have been recovered from cultivated fields near Ponoka, Haynes, Hanna, Rocky Rapids, and in the Grande Prairie region (Gryba 1988:Figures 2.2.18, 2.3.8, 2.3.16, 2.3.18, 2.5.5, 2.5.14, 2.6.17 and 2.6.19). The "atypical fluted points" from the McCord district of southwestern Saskatchewan (Kehoe 1966a:Figure 4a, b, c and 1) appear quite similar to the ones found at Charlie Lake and FhPm-1.

Multiple fluted points, in general, are widely distributed throughout North America. They indicate either a relatively wide time span or recurrence of this trait during the early Palaeo-Indian Period. Three of

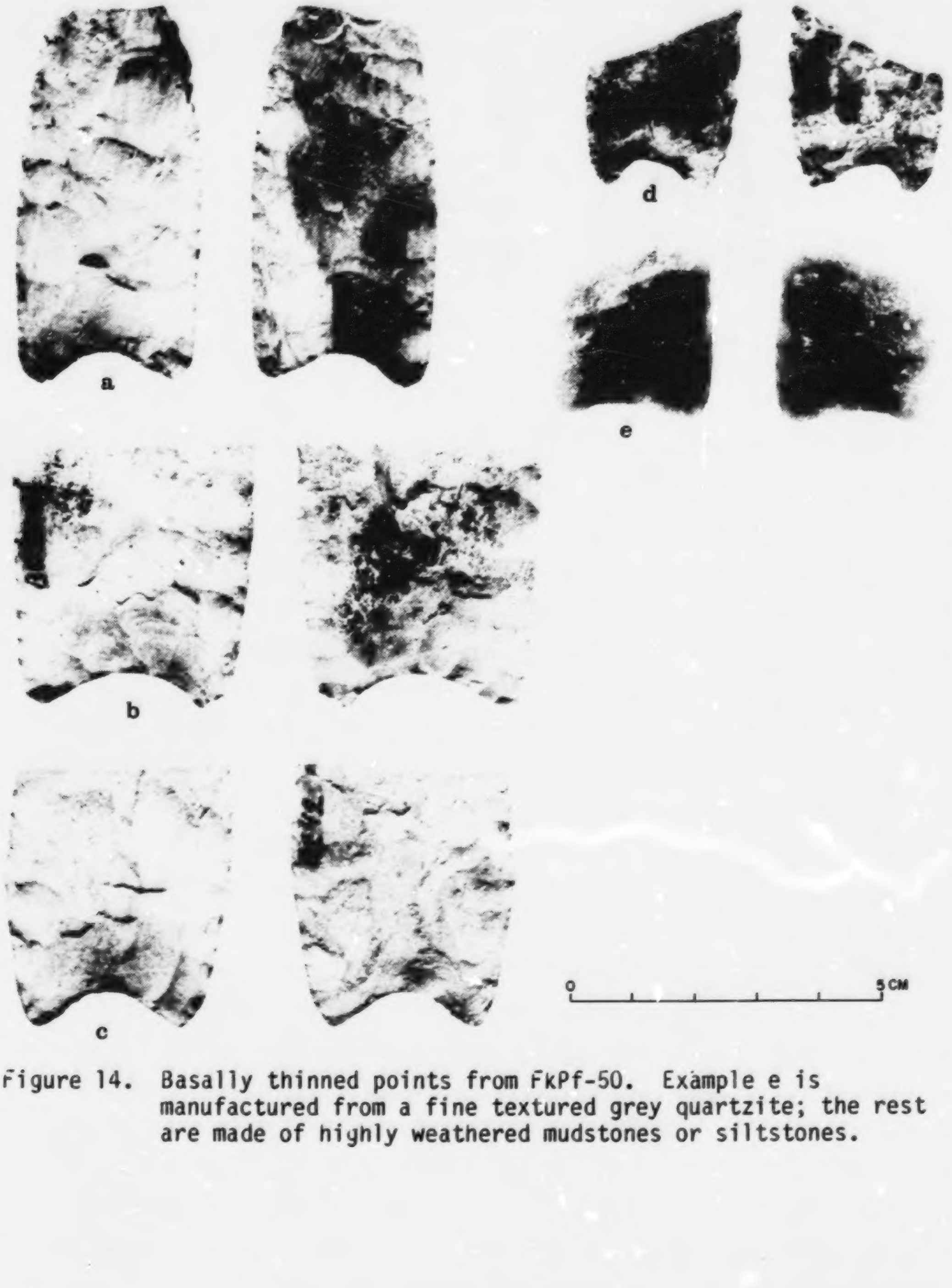

Figure 14. Basally thinned points from FkPf-50. Example e is manufactured from a fine textured grey quartzite; the rest are made of highly weathered mudstones or siltstones.

the Clovis points recovered from the Naco mammoth kill in southern Arizona (Haury 1953:Figure 6a, c and g) display multiple fluting, as do specimens discovered at the Domebo, Oklahoma mammoth site (Leonhardy and Anderson 1966). One of the two specimens from the Levi site in Texas is considered to be of Clovis age (Alexander 1976:22). It has been thinned through the detachment of a series of long flakes. The Goshen Complex at the Hell Gap site is marked by concave-based lanceolate points which exhibit basal thinning through the removal of multiple flakes (Irwin-Williams et al. 1973:46). Although not radiocarbon dated, the writers gave the point a pre-Folsom, post-Clovis placement of around 9,000 B.C, on the basis of stratigraphic evidence. Some Plainview points exhibit pronounced basal thinning (Krieger 1947:Plates 3 and 4), and, in the American west and at the Holcombe Beach site in Michigan, basally thinned Palaeo-Indian points probably postdate Clovis (Haynes 1987:86). Multiple fluted points also occur at Batza Tena, a series of exposed obsidian workshops in north-central Alaska (Clark and Clark 1975, 1980). Obsidian hydration dates on the fluted points from Batza Tena suggest a Palaeo-Indian age (Clark and Clark 1983:287). Thus, while the discovery at Thorsby, as well as the multiple fluted specimens from Bruderheim and other Alberta sites, provide fairly substantial evidence of an early Palaeo-Indian age, only the local discovery of these types of artifacts in reliably dated context would make this assumption indisputable.

THE OLD WOMEN'S PHASE ON THE SASKATCHEWAN PLAINS:
SOME IDEAS

By
David Meyer
Saskatchewan Research Council

INTRODUCTION

On the grasslands and parklands of Saskatchewan, many components which date to the period A.D. 800-1300 are characterized by assemblages containing projectile points of the Prairie Side-notched type, in association with thick-walled, often coarse pottery. Since these culturally distinctive materials consistently occur together, it seems logical that they should be identified with a particular phase. It is proposed here that these remains be assigned to the Old Women's Phase, which, to date, has been recognized only with reference to Alberta materials.

A comparison between the Old Women's Phase cultural remains from Alberta and similar Saskatchewan materials is necessary to determine if the latter should be included in this phase. In this regard, it is pertinent first to outline the characteristics of the Old Women's Phase as it is known in Alberta.

THE OLD WOMEN'S PHASE IN ALBERTA

The term "Old Women's Phase" was employed first by B.O.K. Reeves in his Ph.D. dissertation (Reeves 1983) and other publications (e.g., Reeves 1969b); however, at that time, he did not provide a description of the details of this phase. William Byrne subsequently used the concept of this phase and provided some additional information on its characteristics (1973:467), but it is only in recent years that Reeves has expanded on the details of the Old Women's Phase on the Alberta plains:

> Old Woman's [sic] Phase is characterized by ceramics, emphasizes local Plains or Montana lithics to large measure,

> and has a technology characterized by the extensive use of split pebble techniques to produce blanks for end scrapers, points, pièces esquillées, and burin-like spalls. There is also extensive use made of petrified wood. Projectile point styles are microstylistically discrete, particularly those representative of close of Prehistoric times (Washita) (Reeves 1980:88, in Reeves 1983:19).

Subsequently, the Old Women's Phase has become better known. Brumley and Dau (1987:50-51) have described it as containing projectile points of either the Prairie Side-notched or the Plains Side-notched types (as defined by Kehoe 1966b:830-834), in association with pottery of the sort described by Byrne (1973:331-335, 355-356) under the rubric of the Saskatchewan Basin Complex, Late Variant. This pottery is characterized by fairly thick-walled vessels with rather coarse, poorly consolidated paste. Vessels are usually globular, with rounded or occasionally flattened bases. "Shoulders are quite common and pronounced, frequently reflecting internal or external thickening in the vicinity of the ridge, and necks, when present, are generally shallow and short" (Byrne 1973:334). While many vessels are not decorated, a variety of decorative attributes are present on the rims and lips of others. Punctates are common, and impressions made with coarse, cord-wrapped tools and incisions made with pointed tools also occur. These decorative attributes are incorporated into a variety of motifs, placed on the lip, just below the lip exterior, on the neck exterior, or along the shoulder (Byrne 1973:334-335). Exteriors most frequently bear a vertical cord impression or a fabric impression (often smoothed). A minority are completely smooth (plain).

The Old Women's Phase began around A.D. 800, at which time the projectile points were of the Prairie Side-notched type. These arrowheads were crafted from thin flakes, with a minimum of finishing effort and little attempt to produce a consistent style of side notching. By A.D. 1300, the Plains Side-notched type appeared in Old Women's Phase components. A much more precisely crafted arrowhead, characterized by square basal and notch forms, this point type either developed out of the Prairie Side-notched type or, more likely, was introduced into the Canadian plains from the southeast (Dyck 1983:132; Kehoe 1966b:839). After A.D. 1300, the frequency of Plains Side-notched points in Old Women's Phase components gradually increased, although Prairie Side-notched points were never completely supplanted. The ceramics do not appear to have changed much throughout the history of the Old Women's Phase, although some decorative attributes from neighbouring ceramic assemblages were adopted. The Old Women's Phase ended with the introduction of trade goods, around the mid-1700s.

Based on projectile point morphology, therefore, the Old Women's Phase had two sequential expressions: an earlier form with Prairie Side-notched projectile points and a later form with increasing numbers of Plains Side-notched projectile points (Reeves 1983:20; Vickers 1986:100).

THE EARLY OLD WOMEN'S PHASE IN SASKATCHEWAN: A.D. 800-1300

There are numerous Saskatchewan sites, dating to ca. A.D. 800-1300, which contain assemblages similar to those characteristic of the Old Women's Phase in Alberta. A good example of such a component is the uppermost prehistoric occupation at the Garratt site, on the outskirts of Moose Jaw (Figure 15). Here, 19 Prairie Side-notched and two Plains Side-notched points were recovered, as were 254 potsherds from at least ten vessels (Morgan 1979). The nature of the vessel profiles can be discerned in only three cases. These have prominent or angular shoulders, constricted necks, straight or out-flaring rims and flat lip surfaces (e.g., Figure 16). Seven of the ten vessels have cord-impressed exteriors, vertically oriented in five cases, and another two vessels bear exterior fabric impressions. The exterior finish is uncertain on the tenth vessel, which is represented by only a single rim sherd.

The rims of three of the ten vessels were undecorated; however, one of these had cord-wrapped tool (cwt) impressions in a herring-bone pattern just above the shoulder. Of the remaining seven rims, three bear diagonal cwt impressions on the flat lip surface. One has been reconstructed through to the angular shoulder which is decorated with vertical cwt impressions (Figure 16). The rims of two other vessels have incised decorations: a zigzag along the lip in one case and repeated vertical incisions along the inner corner of the lip in the other. A

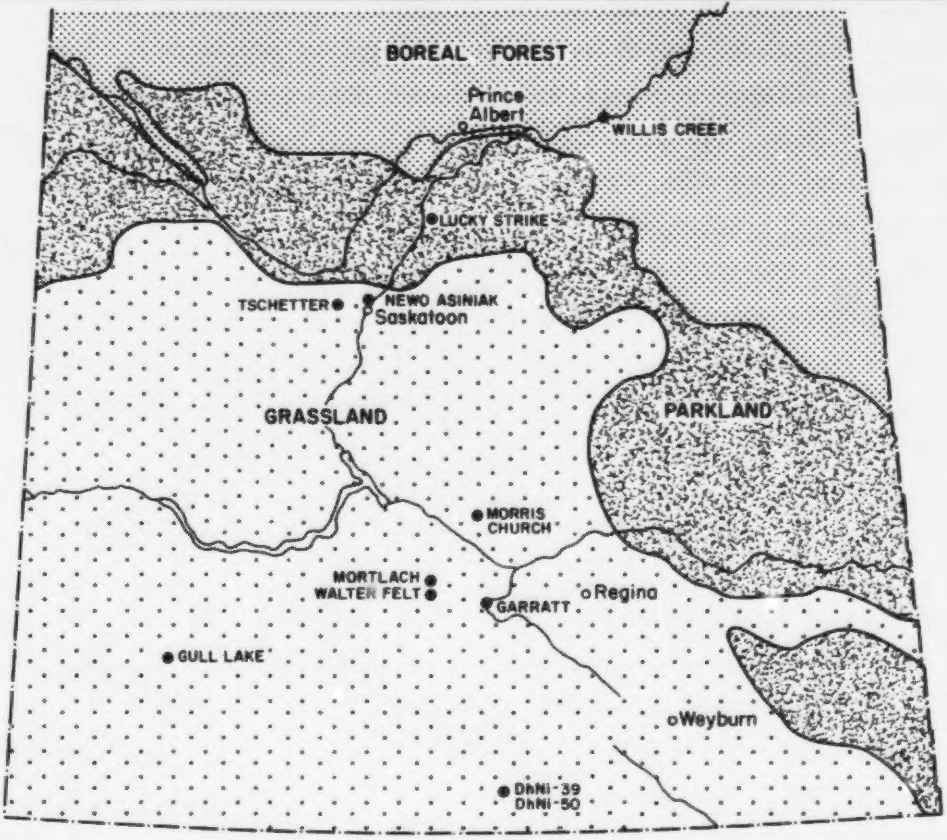

Figure 15. Map showing the location of Old Women's Phase sites in Saskatchewan. The Parkland Zone is after Zoltai (1975) and Harris et al. (1983).

ninth vessel has a round punctate on the lip, and the tenth bears the vertical impression of a round tool on the inner corner of the lip.

In addition to the projectile points, the stone tool assemblage from the Garratt site includes ovoid/crescentic and rectangular bifaces of various sizes, a drill tip, unifaces (including endscrapers), pièces esquillées and hammerstones. In terms of the materials represented by the lithic debitage and tools, sard chalcedony (also known as silicified peat) composed about 40 percent of the total (Morgan 1979:281). Chert made up another 30 percent, and Knife River Flint represented about 15 percent. Other materials were present in much lower percentages.

Components at a number of other Saskatchewan sites (Figure 15), dating to the period A.D. 800-1300, have produced assemblages similar to

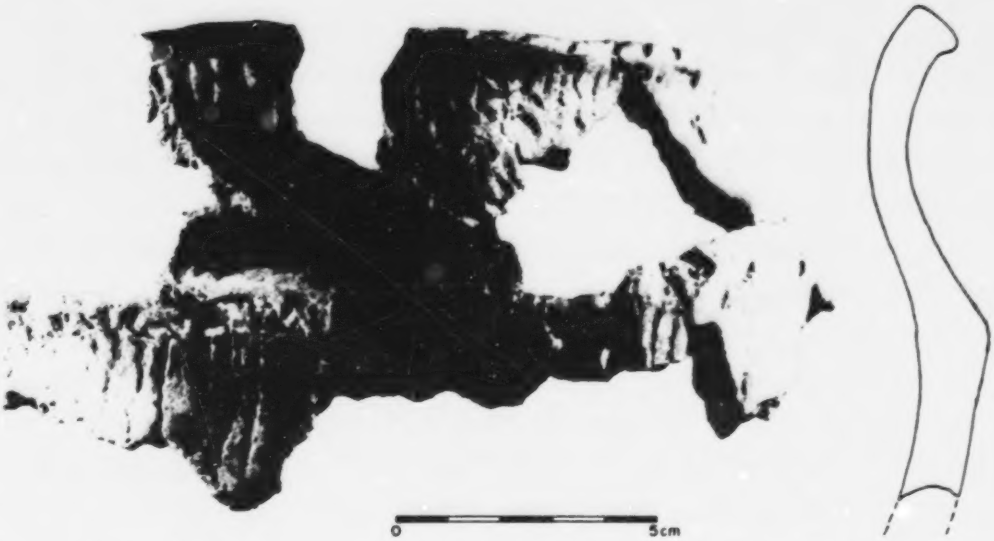

Figure 16. Partially reconstructed vessel from the Garratt site.

that of the Garratt site. For example, such components are present at the Tschetter site, west of Saskatoon (Prentice 1983); the Newo Asiniak site in the Tipperary Creek valley, just north of Saskatoon (Kelly 1986); the Lucky Strike site, some 55 km north of Saskatoon (Wilson 1984); the Morris Church site (lower level) near Chamberlain (Kehoe and Kehoe 1968:31); the Walter Felt site, south of Mortlach (Kehoe and Kehoe 1968:31-32); and the Gull Lake site (Kehoe 1973:118-125).

The artifacts of the above assemblages and the Garratt site assemblage appear to be quite similar to those of the Alberta Old Women's Phase of A.D. 800-1300. In both cases, projectile points are of the Prairie Side-notched type, and the ceramics are similar in profile, decorative attributes, paste characteristics and exterior surface finish. As well, the lithic remains are similar: locally available materials are favoured, and bipolar reduction techniques are used frequently. On the basis of these similarities, it is considered that all of these assemblages can be assigned to the Old Women's Phase.

While these assemblages provide evidence of a major Old Women's Phase occupation in Saskatchewan in the period A.D. 800-1300, the precise distribution of Old Women's Phase sites is difficult to determine. It appears that they are not found regularly north of the parklands (Figure 17). For instance, in the course of the multi-year Nipawin project, we investigated only one small component (Willis Creek site, FhNc-103) with Prairie Side-notched points and some coarse potsherds (Finnigan et al. 1983:141; Figure 15). The southern extent of the distribution of Old Women's Phase sites is also unclear. In general, such sites appear to be rare in that part of southernmost Saskatchewan within the Missouri River drainage basin; however, Saskatchewan Research Council archaeologists have recently examined two sites (DhNi-39 and 50) with apparent Old Women's Phase components in the Coronach region of south central Saskatchewan, only a few kilometres north of the Montana border (Figure 15). One of these sites, DhNi-39, yielded Prairie Side-notched projectile points (Meyer and Beaulieu 1987:163, 166), while nearby site, DhNi-50, contained some thick, disintegrating body and rim sherds of the sort usual to Old Women's Phase components. Looking to the east, it is not certain if these components are found in southwestern Manitoba.

THE LATE OLD WOMEN'S PHASE: A.D. 1300-1750

The later expression (ca. A.D. 1300-1750) of the Old Women's Phase is not as well represented in Saskatchewan. Rather, Selkirk Complex sites (Meyer and Russell 1987) are present into the northern part of the parklands, while components of the Mortlach Phase (Joyes 1973; Syms 1977:125-126) are dominant to the south (Figure 18). The later expression of the Old Women's Phase is believed to have been present in west central Saskatchewan; however, this is a subjective impression based on observations of surface collections in the region. It is noteworthy that Mortlach Phase components have not yet been encountered in this part of the province.

There is one possible candidate for a late Old Women's Phase component in south central Saskatchewan. Wettlaufer's Moose Jaw "Culture" at the Mortlach site (Figure 15) appears to include Old Women's Phase materials and has been assigned to the Protohistoric Period (1955:23-35). As Byrne has noted, however, "considering also the fact that Reeves (1966:66-67) found numerous inconsistencies between the field catalogue proveniences of many artifacts and their published

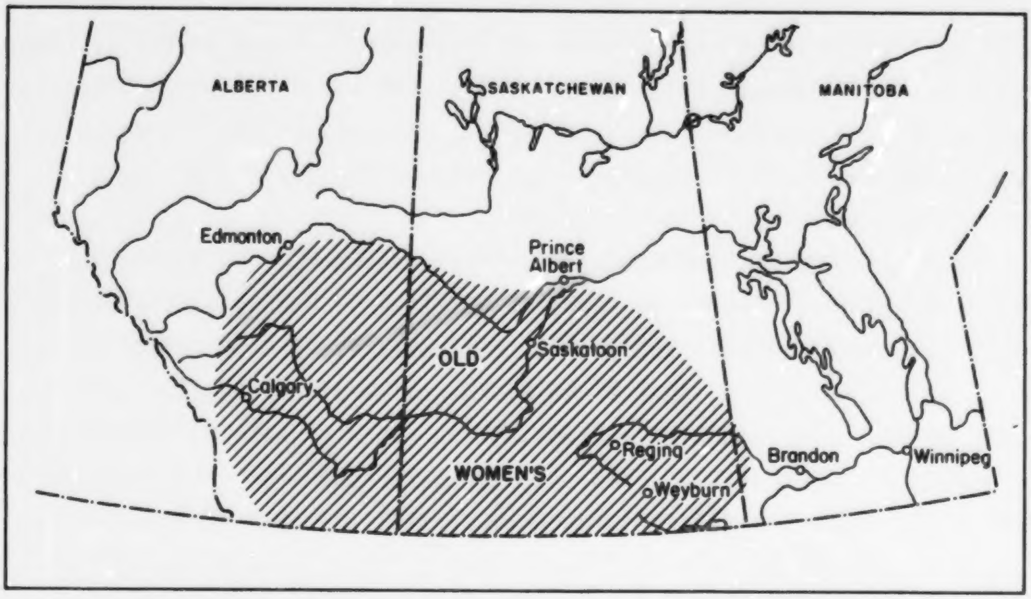

Figure 17. Map showing the approximate distribution of Old Women's Phase sites of the Prairie Side-notched period (ca. A.D. 800-1300).

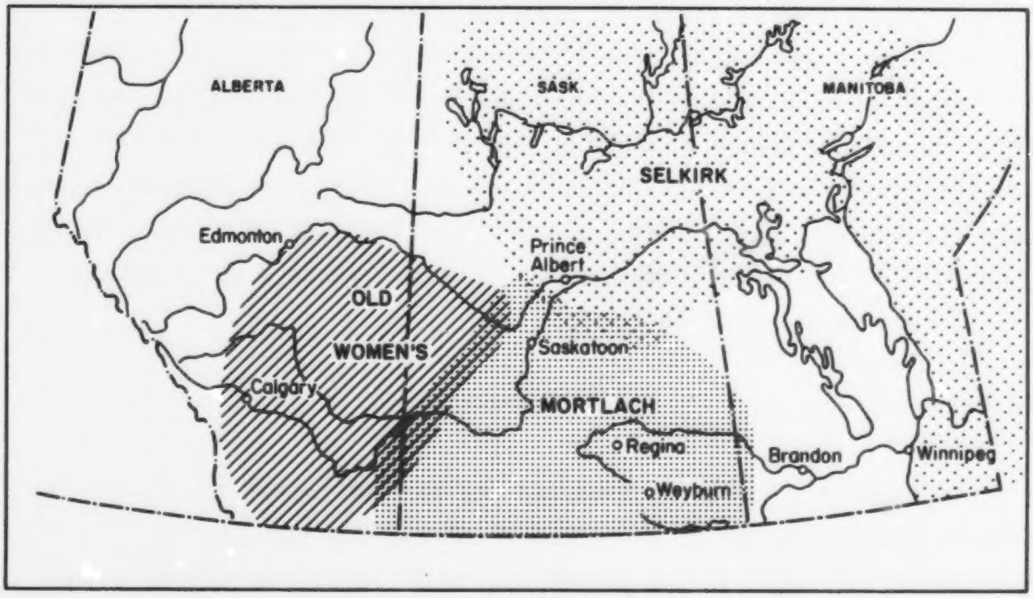

Figure 18. Map showing the distribution of Old Women's, Mortlach and Selkirk in the period ca. A.D. 1300-1750.

affiliations, the age and cultural relationships of many of the specimens are somewhat in doubt" (1973:394). Therefore, it is not known if these remains are of the A.D. 1300-1750 period. At present, no Old Women's Phase component of the latter period is known for certain in south central Saskatchewan.

In his report on the Mortlach site excavations, Boyd Wettlaufer first proposed the "Mortlach Phase" (1955:19-22). Subsequently, this phase was described more fully by Dennis Joyes (1973:83), while E. Leigh Syms (1977:125-126) included it in his overview of northeastern Plains archaeology. Problems with the definition of this phase have been outlined by Johnson (1977:47-48) and Schneider and Kinney (1978:33-36). The Mortlach Phase is characterized by Plains Side-notched projectile points and ceramics containing numerous attributes and motifs shared with Middle Missouri River ceramics of this time period. Almost all assemblages of Mortlach Phase ceramics also exhibit occasional traits characteristic of Selkirk ceramics - such as smoothed exterior fabric impressions, cord-wrapped tool impressions on the lip, or a single row of punctates around the rim exterior. It appears that some characteristics of Old Women's Phase ceramics were also incorporated into this ceramic assemblage (e.g., occasional angular and decorated shoulders). It remains to be determined if the Mortlach Phase materials form a culturally homogeneous unit or if several regional/temporal phases should be recognized. Certainly, as Byrne has detailed, Saskatchewan Mortlach Phase ceramics are very similar to those of his One Gun Phase (Cluny complex pottery) (1973:423-431). Mortlach Phase assemblages occur not only in southern Saskatchewan, but also in northeastern Montana (e.g., Johnson 1977; Joyes 1973; Quigg 1986) and northwestern North Dakota (e.g., Schneider and Kinney 1978).

SUMMARY

In summary, people who produced the earlier expression of the Old Women's Phase were the major occupants of the Saskatchewan grasslands/parklands in the period A.D. 800-1300. Subsequently, the Saskatchewan plains were occupied by the people who produced the Mortlach Phase, with forest groups (Selkirk) pressing into the northern edge of the parkland. In this later period, Old Women's Phase occupation presumably became restricted to the western side of the province.

ACKNOWLEDGEMENTS

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My gratitude is extended to Kit Krozser for making available the potsherds from the upper levels of the Garratt site. As well, I much appreciate Carol Beaulieu's aid in photographing some of the latter potsherds. An earlier version of this paper constitutes Saskatchewan Research Council Publication No. E-903-5-A-88.

THE MANAGEMENT AND CONSERVATION OF ALBERTA ROCK ART: BACKGROUND AND PRELIMINARY RECOMMENDATIONS

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INTRODUCTION

Although the number of rock art sites in Alberta is low, relative to other regions of Canada, some of the finest examples of this fragile archaeological resource are found here. The rarity of this resource increases its importance and its need for protection and interpretation. Of the 72 confirmed rock art sites in Alberta, 59 are found on the sandstone cliffs along the Milk River of southern Alberta. This area includes Writing-On-Stone, one of the most important such sites in the world (Figure 19). At this site, many important petroglyph panels are included within the boundaries of Writing-On-Stone Provincial Park and so benefit from a certain amount of protection. On the other hand, many panels at Writing-On-Stone and most of the remaining sites in the foothills and Rocky Mountains of Alberta lack any suitable protection and interpretation. Properly protected and interpreted, some of these sites present enormous tourist potential. In the meantime, however, it is imperative that no development proceed in the vicinity of these sites without absolute control over their protection and that a concerted effort be made for their management and conservation.

A review of the literature for the purpose of planning the management and conservation of Alberta rock art reveals two important observations. First, although it appears that some processes of deterioration can be slowed down, it is unlikely that truly effective measures of in situ conservation of rock art will be found (Taylor et al. 1979). Second, while many of the processes of rock art deterioration are known and although methods of applied conservation have been proposed (Avery 1978; Clarke 1978b; Dolanski 1978; Grant 1981; Smits 1975, 1978;

Figure 19. Cliff faces at Writing-On-Stone which contain the 26 rock art panels of DgOv-2.

Taylor 1978; Taylor et al. 1979), few experimental applications of conservation measures have been made. Furthermore, little data on long-term observations of deterioration processes or conservation measures have been published.

The increasing numbers of conferences on rock art conservation (Anati et al. 1984; Bednarik 1987; Museum 1982; Pearson 1978) reflect the growing recognition of the limitations of efforts made to date and the urgent need for more research. These conferences have defined priorities for international rock art conservation, and their recommendations stress the need for inventory and documentation, followed by preservation and conservation. Management and public education are also necessary for long-term maintenance of rock art sites. Keeping these observations and recommendations in mind, a programme for the management and conservation of rock art sites in Alberta should consist of four components: inventory, documentation, management and conservation.

A NOTE ON TERMINOLOGY

The general North American terms "rock art," "pictograph" and "petroglyph," as accepted and standardized by Jones (1981), Wainwright (1985) and others, will be utilized in this paper. "Rock art" refers to all forms of human-rendered figures on a rock substrate. "Pictograph" refers to rock art which has been completed without disturbing the rock surface (usually an applied colouration), and "petroglyph" refers to rock art produced by pecking, incising, scratching or abrading the rock surface. "Figure" refers to a single definable unit of rock art, while "morph" refers specifically to pictograph elements and "glyph" to petroglyph elements.

ROCK ART INVENTORY, DOCUMENTATION, MANAGEMENT AND CONSERVATION: A REVIEW OF THE LITERATURE

INVENTORY

A comprehensive and accurate inventory of rock art is a fundamental prerequisite for all aspects of rock art research (Anati et al. 1984; Hachid 1987; Swartz 1981a; Wainwright 1985). In addition to its intrinsic scientific and cultural value, an inventory is necessary to identify sites and assess their need for documentation, management and conservation. An inventory allows the establishment of a system for classifying the protection priority of each site, a necessary first step in devising a practical plan for rock art preservation. Furthermore, conservation requirements will vary from site to site (Taylor et al. 1979), and an inventory provides the basis for assessing the specific requirements for each rock art site. A complete inventory would consist of a confirmation of the location and status of all reported sites and the inclusion of all relevant data in a central file, such as the site inventory presently used by the Archaeological Survey of Alberta (see Figure 20).

DOCUMENTATION

Since the probable fate of all in situ rock art sites is eventual obliteration, the most important form of preservation is the detailed recording of each site (Anati et al. 1984; Swartz 1981b; Taylor 1978; Taylor et al. 1979; Wainwright 1985). Complete documentation may be the only long-term record of most sites, thus minimum recording standards

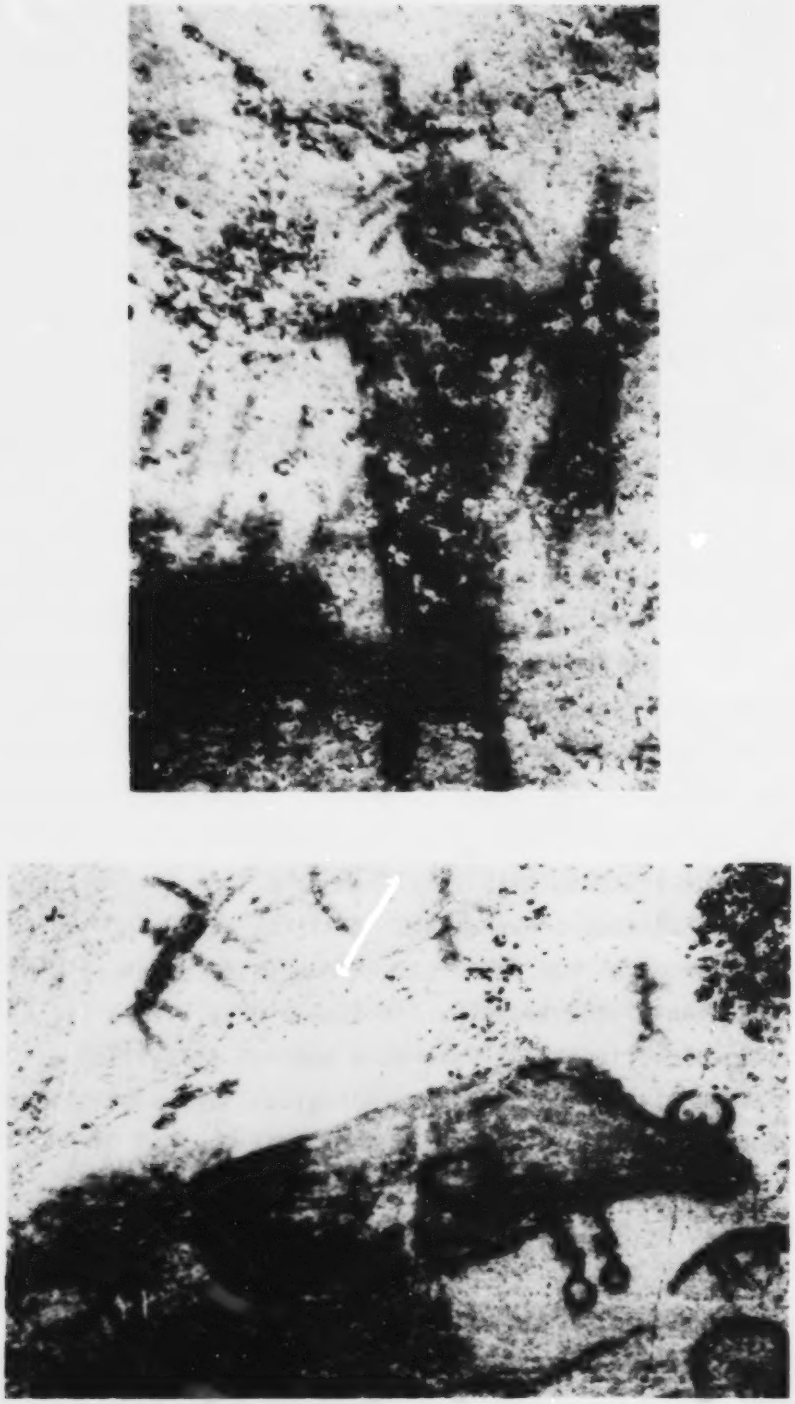

Figure 20. Photographs of exceptional pictographs from an unknown location left at the Archaeological Survey of Alberta with no documentation.

(Rosenfeld 1978; Swartz 1981a; Wainwright 1985) should include the following:

(1) complete objective metric and descriptive observational data,
(2) photographs,
(3) tracings,
(4) maps of faces and sites, and
(5) general subjective descriptions.

Detailed descriptions of recording methodologies for metric and observational data can be found in Evans (1971), Jones (1981), Swartz (1981b) and Wainwright (1985). Many authors discourage any recording method which involves contact with rock art surfaces when these surfaces are friable or unstable in any way. Several of the most common recording methods are discussed below.

Tracing

Tracing rock art allows the recorder subjective flexibility in selecting the attributes to be recorded (Rosenfeld 1978), but this subjectivity can lead to considerable misrepresentation of rock art (Dewdney 1979). The subjectivity and lack of three-dimensional data in tracings suggest that they should not be used in isolation but should complement other recording methods, such as photography (Wainwright 1985).

Tracings and drawings must be executed with great care by skilled and competent recorders. When tracing is to be done, the acetate and pen method has been recommended (Jones 1981; Keyser 1977; e.g., Figure 21), but these tracings must be recopied onto archival quality paper immediately because of their unstable nature (Wainwright 1985). Chalk on rice paper is an alternative (Dewdney 1970; Wainwright 1985). The importance of tracing increases for pictographs which are difficult to record photographically. When the surfaces of rock art sites are too friable for safe tracing, the photographic tracing method used by Brooks (1975) and Baravelle (1981) might be effective.

Moulding and Casting

Casting petroglyphs is one way to make a complete, three-dimensional record ideal for long-term documentation and interpretation. However, the damage that can be caused by moulding often outweighs the benefits.

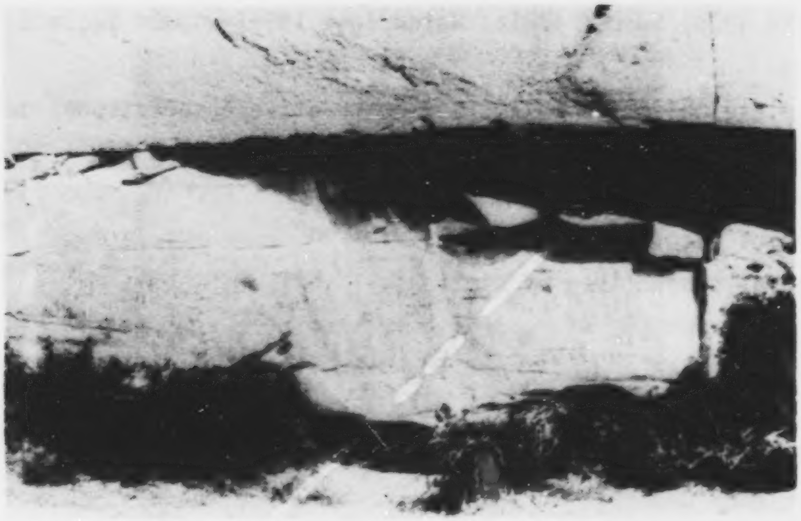

Figure 21. The acetate and felt pen method used by Keyser (1977) to trace the battle scene, DgOv-81, at Writing-On-Stone.

Moulding materials, such as latex, can flow into microscopic pores and fissures causing irreparable damage to the surface when they are pulled off (Wainwright 1985). This is particularly the case with soft sandstones like those found at Writing-On-Stone (Keyser 1977:11). Although casts have been made at a number of sites (Beauchamp 1982; Clegg 1978; Simonsen 1980), moulding is not recommended as a rock art recording technique except for salvage purposes (Swartz 1981b; Wainwright 1985). When moulding is absolutely necessary, silicone (Brand 1974; Wainwright 1985) or aluminum foil (Clegg 1978) methods have been recommended. An alternative method for reproducing accurate, three-dimensional copies of petroglyphs may be possible through the use of stereophotogrammetry (Bell and Letellier 1983).

Stereophotogrammetry

Stereophotogrammetry has considerable potential as a rapid, relatively inexpensive and accurate recording method for both petroglyphs (Bell and Letellier 1983; Clegg 1978; Clouten 1976; Rivett 1978; Scogings 1971) and pictographs (Clouten 1976; Turnpin et al. 1980; cf. Bell and Letellier 1983). Stereophotogrammetry produces high-resolution, distortion-free, archival-quality photographs and also can be used to produce accurate, scaled drawings with contour-plotting, cross sections and three-dimensional contextual information. In addition, it may be possible to use stereophotogrammetry on a periodic basis to monitor the deterioration of rock art and rock surfaces (Bell and Letellier 1983; Scogings 1971).

Photography

While stereophotogrammetry may be the best photographic recording method, its use may not be possible in every case. A number of ways to enhance the quality of regular photography include night flash photography, which allows greater control over lighting and contrast, as well as ultraviolet and infrared photography, which have been used to enhance some pigments. Wainwright (1985), on the other hand, found that ultraviolet and infrared photography were not successful when photographing red ochre pictographs. Night flash photography improved petroglyph images, while simple colour photography of all rock art was enhanced with such special techniques as colour correction, light balancing and polarizing filters. Painting (Beauchamp 1979) or chalking (Leen 1981) the surface to improve the contrast is not recommended because of the potential damage and loss of objectivity. Overall, photography can be an effective recording method if professional techniques are utilized; however, photographs are unstable and must be adequately protected from deterioration if they are to be a long-term record. A comprehensive review of photographic techniques for recording rock art is presently in preparation by Wainwright (personal communication 1988).

Other Documentation

Full documentation of rock art sites entails much more than just tracings and photographs. Before any alteration of sites for conservation purposes can proceed, care must be taken that all relevant data have been extracted (Anati et al. 1984; Swartz 1981b). For the most part, this involves collection of data which may be useful for dating purposes. Mineral deposits, patination and condition of weathering all might provide dating information (Bard et al. 1978; Dewdney 1970; Jones 1981; Knauss and Ku 1980). If a vehicle (medium) was used, pigment samples may also contain enough organic material for accelerator radiocarbon dating, and these samples must not be contaminated (Butzer et al. 1979; Jones 1981; Thackeray 1983; Van der Merwe 1982). Lichen is still occasionally suggested as a possible dating variable, but the consensus seems to be that the potential of lichenometry is negligible (Jones 1981; Taylor et al. 1979).

MANAGEMENT

Two categories of management policies are required for rock art sites: an open policy for easily accessible, well-known sites and a closed policy for inaccessible, unpublicized sites (Conway 1979; Swartz 1981b; Wainwright 1985). Damage by humans is often the major cause of deterioration at high-profile or publicly known sites (Clarke 1975; Grant 1981; Pohorecky 1979; Smits 1978; Sullivan 1978; Taylor et al. 1979; Wainwright 1985; Wamboldt 1980). Indeed, at least 55 percent of Alberta rock art sites have been substantially damaged by vandalism (Figure 22). Thus, management of known sites should be directed towards supervision and education. At inaccessible and poorly known sites, vandalism is much less of a problem, and natural factors are the major cause of deterioration. The best policy for managing these sites is maintaining their anonymity whenever possible (Conway 1979; Swartz 1981b).

Open Sites

Supervision and Signing

Clarke feels that "if a rock art site is cleaned up, the existing vandalism removed, and informative advisory signs erected, it has a much greater probability of staying that way than a damaged, unmarked site" (1975:82). Others contend that erecting signs and increasing public awareness about rock art only serves to attract greater attention and encourage greater damage (Grant 1981; Smits 1975; Sullivan 1978; Taylor et al. 1979; Wamboldt 1980). Because of these paradoxical effects, it has been suggested that measures which increase public awareness, including signs and interpretation, should always be accompanied by greater supervision of sites. This supervision can take the form of voluntary site wardens (Conway 1981) or paid caretakers (Grant 1981; Sullivan 1978; Taylor et al. 1979). A permanent interpretive presence,

Figure 22. Example of the vandalism suffered by some of the rock art panels at Writing-On-Stone.

either staff only or staff and facilities, is another alternative (Cittadini 1982; Cornford 1979; Pohorecky 1979; Sullivan 1978).

Fencing

Fences have been constructed at a number of sites with the intention of reducing the danger of vandalism. Wainwright (1985) reports that fences were successful at reducing vandalism at the Peterborough Petroglyphs in Ontario. Even so, it has been reported a number of times that fences without supervision result in increased vandalism due to heightened visibility (Grant 1981; Smits 1975; Taylor et al. 1979). In extreme cases, fenced-off sites were broken into and vandalized (Smits 1975). However, it appears that, in general, fencing has been effective when accompanied by a corresponding increase in supervision (Sullivan 1978; Wainwright 1985). The use of adequate fencing also has been successful at preventing damage by domesticated or feral animals.

The drawbacks of fencing are its obtrusive and unsightly appearance and the barrier it presents to photography, research and interpretation. Poorly planned fencing can destroy much of the aesthetic and contextual qualities of rock art.

Access Restrictions

The dangers of heightened public awareness cannot always be offset by supervision alone and may ultimately lead to strict limitation of access to sites. At Kejimkijik National Park in New Brunswick, which was created in part because of the presence of petroglyphs, all rock art interpretation has been phased out and access is restricted (Wamboldt 1980). This change in management policy was in response to the negative impact of increased visitation, despite constant supervision. Similar experiences have been reported in Australia (Sullivan 1978). Although restricting access to the sites within Writing-On-Stone Provincial Park also has been necessary, this measure has been integrated with interpretation and appears to have been successful in reducing vandalism (Keyser 1977). Overall, the most effective policy for high profile rock art sites seems to be a combination of supervision, interpretation and, if necessary, access restriction.

Closed Sites

Files and records of publicly unknown sites should remain closed, and their locations should not be publicized in any way. Nonetheless, inaccessible or non-publicized sites are encountered occasionally by outdoor recreationalists. Although the risk of vandalism by these groups may be low, intentional and unintentional damage can still occur (Brink 1980; Jones 1981). For this reason, discrete signing of inaccessible sites may be advisable. Placed in locations where they will be seen only by those who have already discovered the sites, signs may prevent some damage (Brink 1980). In some cases, a closed policy may conflict with the mandate of previous legislation. For example, it may be the obligation of provincial or national parks to promote previously unknown rock art sites. Although the protection versus access and interpretation issue is a difficult one to resolve, if a decision supporting increased awareness is made, a corresponding decision to increase supervision should follow.

CONSERVATION

Background

Although numerous suggestions have been made and experiments undertaken, the effective application of rock art conservation techniques has been minimal. One priority has been the identification of the processes of rock art deterioration (see Table 5). In general, humans and water (Figure 23) have been found to be responsible for the majority of damage to rock art (Avery 1978; Taylor et al. 1979; Wainwright 1985). Human-originated damage can be regulated only by effective management (Sullivan 1978), and conservation is of little use in this regard. On the other hand, conservation measures may be able to slow down the rate of deterioration from natural causes, such as water (Taylor et al. 1979).

For the most part, conservation to date has consisted of consolidating existing conditions and reducing some of the destructive potential of the agents responsible for deterioration. Before more specific conservation measures are suggested or attempted, a number of points should be considered:

(1) Since the conditions and factors of deterioration differ from site to site, conservation measures must be planned according to the specific needs of each individual site.

(2) Each site must be thoroughly recorded and all relevant data extracted (e.g., dating samples) before conservation measures are implemented to ensure that no information is lost.

(3) Careful experimentation with conservation techniques, both in the lab and in the field, should be undertaken to determine if adverse effects may result from the conservation measures.

The most important antecedent to the onset of conservation work should be a detailed site by site examination of the causes of rock art deterioration. Qualified professionals, such as geologists and geomorphologists, should be involved in assessing these deterioration factors so that appropriate conservation approaches can be chosen. Significant reviews of methodologies and deterioration analyses have been presented by Clarke (1978a), Jones (1981), Wainwright (1985) and Walston and Dolanski (1976). In the following section, causes of deterioration and some conservation techniques are reviewed.

Table 5. Factors for rock art deterioration analysis (modified from Wainwright 1985).

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1. Climatological and geological data

2. Large-scale alteration and deformation
    - tectonic processes
    - gradational processes

3. Major geophysical and geochemical weathering
    - frost action, cracking, exfoliation
    - salt weathering
    - solution weathering
    - chemical alteration
    - surface deposits

4. Other geophysical and geochemical weathering
    - thermal contraction/expansion
    - efflorescence and subfluorescence
    - moisture swelling
    - wind abrasion
    - oxidation, reduction, carbonation
    - hydration, hydrolysis

5. Biological weathering
    - microorganisms, bacteria
    - algae, lichen, moss
    - higher plants (roots)
    - mammals, birds, insects

6. Human-caused deterioration
    - vandalism
    - occupancy, tourism
    - development
    - improper recording methods

Natural Causes of Deterioration

While the greatest immediate threat to rock art is often vandalism, numerous other causes of deterioration have a natural origin. Rain, run-off, surface moisture and ground water all contribute to solution weathering, salt crystallization, exfoliation and mechanical erosion of rock substrates. Weathering and erosion result in the eventual loss of petroglyph definition and pictograph surfaces, while the deposition of mineral layers by water obscures rock art. Additional processes of deterioration include the actions of biological agents and exposure, as

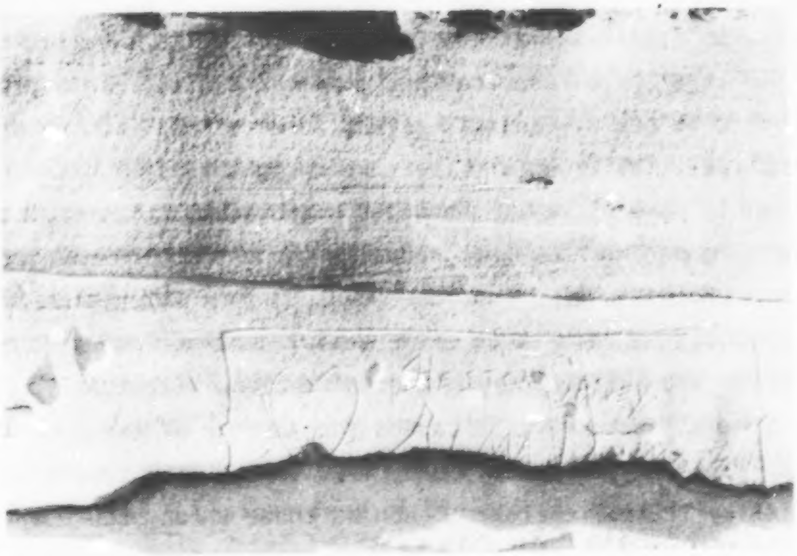

Figure 23. Petroglyph panel at Writing-On-Stone which has been nearly obliterated by natural and human-caused deterioration.

well as other forms of mechanical erosion (Beauchamp 1982; Clarke 1978a; Taylor et al. 1979).

Water-based Deterioration

Most natural deterioration of rock art has its origin in the presence of water. Solution weathering results when carbonate rocks or cements slowly dissolve in water, and this process is accelerated by pollution (Price 1975; Wainwright 1985; Winkler 1971). The rock surface is weakened and crumbled, and loosened particles are subsequently removed by mechanical erosion (Price 1975). The evaporation of water from porous rock results in the crystallization of dissolved salts, and salt already present in the rock can also become hydrated through contact with water. Both processes produce surface crusts (efflorescence). The growth of salt crystals and salt hydration produces pressures within the pores of rock masses, causing rapid disintegration of rock surfaces (Clarke 1975; Price 1975; Sullivan 1978; Taylor et al. 1979; Wainwright 1985). Similarly, the expansion and contraction of montmorillonite within sandstones from changes in humidity have been implicated in the subtle deterioration of the rock art surfaces at Altamira Cave, Spain (Wainwright 1985). Presumably, this process would affect all sandstones with clay mineral content.

The terms "spalling" and "exfoliation" refer to the flaking of rock surfaces in layers from chemical and physical causes. This process is considered to be one of the most severe forms of rock art deterioration (Beauchamp 1982; Taylor et al. 1975; Wainwright 1985). Water can cause exfoliation in several ways. As water evaporates, salts crystallize near the surface in porous rock and gradually block the pores of the capillary system in a process called subfluorescence. This alteration of the rock surface composition results in differential contraction rates between the rock interior and surface during thermal cycles. Eventually, the pressure from this contraction causes the surface of the rock to spall off (Price 1975; Taylor et al. 1975, 1979). Spalling is greatly accelerated by thermal extremes, such as those which occur during fires (Hughes 1978; Taylor et al. 1979). Alternatively, exfoliation can be caused by freeze-thaw cycles. Thermal expansion and contraction of the surface form fissures parallel to the rock surface. During the spring and fall, water penetrates these fissures and freezes, causing panels to crack off (Avery 1978; Beauchamp 1982; Taylor et al. 1979; Wainwright 1985).

Mechanical Processes

Mechanical processes of erosion include the effects of wind, running water and frost action (discussed previously). Although at times mechanical processes have been considered to be major factors in rock art deterioration, it is more likely that they are secondary to solution and salt-weathering (Clarke 1975). Deterioration caused by salt crystallization is often mistakenly attributed to wind (Price 1975). Generally, processes of mechanical erosion simply remove the rock particles already loosened by other forms of deterioration. Whether this is true for very soft sandstones is questionable, and the importance of mechanical processes needs further clarification.

Biological Processes

Lichen, algae, fungi and bacteria all play parts in rock art deterioration (Chaloupka 1978; Lefevre 1974; Smits 1975; Taylor et al. 1979). Of these, lichen is the most serious and warrants the most attention. The penetration and expansion of lichen rhizomes into the rock substrate produces pitting, the overall effect of which is disintegration of the rock surface. This then allows a greater degree of chemical and other weathering. While the removal of lichen may hasten the immediate deterioration of the rock surface (Florian 1978; Wainwright 1985), the long-term effect would be most certainly beneficial.

Algae growth has been a major problem in European caves (Lefevre 1974) and at the Peterborough Petroglyphs (Wainwright 1985). Algae can even penetrate marble to a considerable depth and cause pitting of the surface. In some cases, insects are also responsible for rock art deterioration. While damage from this process is rare in Canada, it has been noted at Writing-On-Stone (Wainwright, personal communication 1988). One further, obvious form of biological deterioration is the damage to rock masses by plant and tree roots. In general, while the damage from most biological agents appears to be minimal in extent, it often acts as a catalyst for increased water-based disintegration (Beauchamp 1982; Wainwright 1985).

Surface Deposits

Two related processes cause the formation of surface deposits on pictographs: first, they may form when water flows out from the interior of porous rocks and evaporates on the surface (efflorescence; Dolanski 1978; Walston and Dolanski 1976) or, second, they may form from the evaporation of ground water flowing over the surface of the rock (Wainwright 1985). Both processes leave mineral deposits, generally silicates, on the surface. While these translucent "silcrete skins" may initially protect pictographs, eventually they may completely obscure them (Taylor et al. 1979; Wainwright 1985).

The deposition of a layer from efflorescence seems to end when it becomes impermeable (Clarke 1978a), and the layer may then flake or spall off with the subfluorescence of salts behind the layer (Clarke 1978a; Dolanski 1978; Walston and Dolanski 1976). Microscopic examination of ground water surface deposits at pictograph sites in the Canadian Shield and Interior British Columbia regions revealed a silica-rich, amorphous or cryptocrystalline material forming rhythmic layers paralleling the rock surface, with the pigment sandwiched between layers (Myers and Taylor 1974; Taylor et al. 1974; Wainwright 1985; Wainwright and Taylor

1978). The migration of silica into the pigment layer, as well as separation of the pigment into two distinct layers, has been observed (Wainwright and Taylor 1978). Microspalling of the deposit can occur, possibly because of this migration or poorly bonded layers, with the tiny flakes taking pigment with them as they fall off (Taylor et al. 1974; Wainwright 1985; Wainwright and Taylor 1978). The formation of a silcrete skin on some sandstone petroglyphs panels in Australia apparently has strengthened the rock (Walston and Dolanski 1976). The relationship of silcrete skins to petroglyph weathering seems to be a beneficial one in this case. A thin surface deposit has been reported for the petroglyphs at Writing-On-Stone (Wainwright, personal communication 1988), but little is known of its characteristics.

A phenomenon related to surface deposition is patination, or the alteration of rock surfaces due to weathering processes. The formation of desert varnish, which is the slow accretion of a durable layer of iron and manganese on the sandstone surfaces in arid regions, is a type of patination. Desert varnish may affect the weathering rates and obscuration of petroglyphs in desert areas (Bard et al. 1978; Elvidge and Moore 1980). A light desert varnish appears to be present at Writing-On-Stone, but this process has not been adequately documented. The accretion of iron ore dust on petroglyphs has also been associated with accelerated weathering (Clarke 1975, 1978a).

Additional Processes Affecting Pictographs

Most of the processes of deterioration described above affect both pictographs and petroglyphs; however, pictographs are subject to additional processes. For example, they may fade from ultraviolet exposure (Avery 1978) or suffer from iron staining (Chaloupka 1978). More importantly, pictographs rely on a bond between rock surfaces and pigments, and several factors influence the permanency of this bond, including the composition of the rock surface, the pigment and the vehicle (binding medium of the pigment), as well as the relationship of the pigment to the surface deposits and substrate (Chaloupka 1978; Clarke 1976, 1978a, 1978b; Smits 1975; Wainwright 1985). The presence and composition of the vehicle is not clearly understood. The apparent absence of a vehicle in Canadian Shield pictographs may have increased their durability by improving the direct bonding of the pigments to the substrate (Wainwright 1985).

Erosion Rates

One aspect of a deterioration analysis is the measurement of natural erosion rates. A device that can make this measurement is the microerosion meter (Smith 1978), which is capable of measuring erosion on the scale of 0.002 mm. Use of a similar device was proposed for monitoring the rate of deterioration of the limestone surface at the Peterborough Petroglyphs (Adams et al. 1975), but this was never fully implemented (Wainwright, personal communication 1988). Stereophotogrammetry is another method which may provide a precise record of deteriorational changes (e.g., Bell and Letellier 1983).

Methods of Conservation

While natural erosion rates are usually quite slow (Hughes 1978; Keyser 1977), erosion is a continuous process, and, once conditions favourable for deterioration occur, it can become very rapid. It is unlikely that natural weathering can ever be stopped, but a number of positive steps can be taken to minimize its effects. These steps generally fall into two categories: removal or reduction of destructive agents and consolidation or strengthening of rock art surfaces and substrates.

Reduction of Water Damage

As water has been identified as one of the major causes of rock art deterioration, a corresponding degree of emphasis should be placed on reducing the effects of this agent. A practical and often recommended route is improving drainage conditions above and around rock art sites and diverting run-off, ground water and surface moisture through the use of gutters, drip lines, channels and grouted cracks (Avery 1978; Clarke 1978b; Kennedy 1979; Smits 1975; Sullivan 1978; Taylor et al. 1979; Wainwright 1985; Wainwright and Taylor 1978; Walston and Dolanski 1976). While technically simple, the application of these water reduction measures is a large-scale and involved undertaking, which would require few materials but considerable planning and labour. Even so, the overall benefits of this undertaking would make it worthwhile in many situations.

Shelters

To control the effects of the elements and water, the use of shelters has been advocated (Smits 1978; Wainwright 1985, 1987). However, rudimentary shelters may cause greater damage by promoting condensation and the growth of algae, moss and lichen (Cornford 1979; Kennedy 1979). If shelters are to be built, the environmental changes which may result should be understood beforehand. Shelters must be capable of preventing the potentially destructive alteration of temperature, humidity and light regimes. In France, for example, it was necessary to control the climate of rock art caves through complete isolation of the internal environment and by carefully regulating air condition in order to maintain the paintings (Brunet and Vidal 1980, 1984). Shelters which allow climate and access control would also be very useful in reducing frost weathering, vandalism and biological growths (Taylor et al. 1979; Wainwright 1985). A high-quality, fully enclosed structure built over the Peterborough Petroglyph site apparently has been successful in reducing all forms of deterioration (Wainwright 1987). However, a major drawback of shelters is effective loss of the natural setting of the site, one of the most valuable interpretive and aesthetic qualities of in situ rock art. In addition, the expense of constructing adequate shelters often makes them impractical. It is necessary, therefore, to weigh these negative aspects against the scientific and preservational benefits before a decision to build is made.

Removal of Surface Deposits

Although surface deposits may obscure and eventually damage rock art, the highly complex interaction of pigment materials and these deposits makes it difficult to remove them safely. The deposits are often uneven in thickness; the number of layers over the pictographs can vary; and the pigment materials have often migrated into succeeding layers of deposition. Therefore, removal of overlying deposits runs the risk of damaging the pictograph components. It is absolutely necessary that a microscopic cross section of the pictograph is made before removal of deposit layers is considered. Even under the best circumstances, the risks involved suggest that this route should be avoided.

Removal of Rock Art

The removal of rock art panels to museums or other safe storage locations is undesirable for the same aesthetic reasons as shelters, but removal is an even more extreme alternative. Unfortunately, there may be cases where an immediate and irreversible threat, such as advanced spalling (Taylor et al. 1979) or flooding (Wainwright 1985), makes removal of the rock art the only alternative (Smits 1975). However, in general, removal should be regarded as a last-ditch approach, to be considered only after every other alternative has been explored.

Removal of Biological Agents of Deterioration

Lichen is the major biological agent affecting rock art. The damage to rock art surfaces caused by the growth of lichen outweighs the potential that it may have for dating purposes (Beauchamp 1982; Jones 1981; Taylor et al. 1979; Wainwright 1985). Although removal of lichen may cause some damage (Florian 1978; Wainwright 1985), it is a prudent, long-term approach. Direct mechanical methods of lichen removal should be avoided, and biocides should be used only after careful experimentation has assessed the possible adverse side effects of their use (Taylor et al. 1979; Wainwright 1985). Recommended biocides and chemicals and their use are discussed in Clarke (1978b), Florian (1978), Kennedy (1979), Taylor et al. (1979) and Wainwright (1985, 1986). Biocides should also be used to remove algae, moss, fungi and bacteria.

Artificial Consolidation of Surfaces

On first thought, the chemical consolidation and stabilization of porous rock art surfaces appears to make sense. This technique increases the resistance of the rock to the deteriorating effects of water and other agents; however, it also involves a number of hazards. For example, initial attempts at protection by sealing the rock art surface with synthetic compounds had disastrous results (Smits 1968, 1975). These compounds often weathered or discoloured, obscuring the rock art, and also failed to take into account the natural "breathing" of rock.

Obviously, the application of any chemical consolidation technique should be approached with caution.

In view of the problems discussed above, it is surprising to find that simply sealing the surface of rock art is still attempted occasionally. For example, Simonsen (1980) describes one site which was sealed with paint and then backfilled to protect it from the elements, without published justification of the sealing method. Artificial surface sealing remains an approach that is not recommended. On the other hand, the formation of "silcrete skins" naturally seals rock surfaces and may initially protect pictographs from deterioration. In some cases, the skins remain very thin and semi-permeable (Dolanski 1978; Watchman 1987), and this may explain why spalling is not necessarily associated with these deposits. Deposition layers may eventually lead to obscuration and microspalling, but nonetheless Clarke (1978a), Dolanski (1978) and Watchman (1987) are hopeful that artificial means of enhancing or producing "silcrete skins" may be developed for protecting rock art surfaces. Wainwright (personal communication 1988), on the other hand, is skeptical of the suitability of this process and suggests that it may do more harm than good by encouraging future deterioration.

If rock art surfaces are to be treated with chemicals, the process either must not seal the rock pores entirely or must penetrate the rock to a great enough depth to prevent spalling. Ideally, the treatment should be lasting but reversible, and the chemical should be non-deteriorating. A number of impregnation treatments that may satisfy these conditions have been proposed and partially tested, but so far the results have been disappointing.

The most promising method of chemical impregnation is the in situ polymerization of monomers, with epoxies and acrylics most commonly tested in the past (Clarke 1978b; Munnikendam 1967; Price 1975). Monomers can be applied to rock surfaces in low viscosity liquids which polymerize into solid form within the rock pores. This penetration increases the tensile strength of the rock to a certain depth and/or makes the interior salts inaccessible to water. As well, the immediate mechanical resistance of the impregnated stone to pressure, water and freezing are improved with all epoxy and acrylic treatments. It is difficult to prevent complete surface sealing with this technique (Gauri

1970; Munnikendam 1973), but experimental impregnations of stone with both epoxies (Domaslowski 1969; Gauri 1970; Kotlik et al. 1983; Munnikendam 1973) and acrylics (Munnikendam 1967, 1971; Price 1975; Turner et al. 1979) have resulted in penetration that may prevent spalling.

While these results are encouraging, several difficulties still remain. For instance, long-term observational data on the weathering properties of both types of impregnations are still quite limited. There are indications that the application of epoxies actually accelerates the long-term rate of surface decay (Gauri 1974; Taylor et al. 1979; Wainwright 1985) and that epoxies rapidly break down with ultraviolet exposure (Kotlik et al. 1983; Wainwright 1985). Also, the formation of a white efflorescence on the surface of epoxy-treated stone has been reported (Munnikendam 1973; Price 1975). Acrylics, on the other hand, have a high resistance to sunlight and exposure and also have great strength, transparency and adhesive qualities. Even so, all chemicals may accelerate the rate of deterioration because they may degrade faster than the rock itself or may cause some surface spalling. Unfortunately, most acrylic and all epoxy impregnation experiments have been done on building or statuary stone, and their suitability to rock art is not known. Although acrylics were used to impregnate porous sandstone samples taken from rock art sites in the American southwest (Turner et al. 1979), the application of acrylics to actual rock art surfaces in the field has not been attempted.

The impregnation of rock art sites in the field presents numerous obstacles not found in other applications. For example, vacuum methods of impregnation would be more difficult, and, unlike buildings and statues, rock art panels cannot be isolated from ground water. The latter condition would mean subfluorescence of salts and spalling would be of greater concern. Serious difficulties were encountered when trying to impregnate large stone surfaces with acrylics (Munnikendam 1973), including the problem of initializing polymerization without heating large masses of rock and the inhibition of initialization by oxygen. The use of chemical initiators is also troublesome in that polymerization commences as soon as the components are mixed, and therefore the viscosity of the mixture increases steadily through the application (Munnikendam 1973; Price 1975).

While the data for rock art are limited, experiments in impregnating building and statuary stone are ongoing. Recent emphasis has turned to silicone compounds (Biscontin et al. 1987; Nishiura 1987; Price 1975), which show promise but require further testing and analysis. Treatment of calcareous stone by depositing barium salts within the pores of the rock (Lewin and Baer 1974; Sayre 1971) and the consolidation of stone and clay with soluble sodium silicates (Wihr and Steenton 1971) are other methods which have been used, but they rely on environmental and application constraints impractical for in situ rock art. The known limitations and drawbacks of these impregnation treatments suggest that additional experimentation and long-term observations are essential before chemicals can be considered an effective conservation approach for rock art.

Another possible method using chemicals, but which does not involve impregnation, is spraying rock art with perfluoropolyther water repellants (Wainwright 1985), reported to be stable, colourless, transparent and permeable to water vapours. A similar approach was used in Australia by Clarke (1978b), who sprayed a water repellant silicone resin on a permeable and disintegrating white pigment affected by water penetration. The effect was to stabilize the pigment by reducing water penetration and increasing its strength, but the long-term effects of this treatment are not known. (This method would not be effective with ochre-based pigments because of their dissimilar properties [Clarke 1978b]).

Physical Stabilization of Rock Substrates

A number of techniques are possible for physically stabilizing rock masses which have fractured or threaten to fracture. For example, the entire mass could be grouted with a cement slurry injected into the rock, although this has not been attempted at rock art sites. The drawbacks of this method are its technical difficulty and irreversible nature and the possibility of altering the rock art itself through surface extrusion of the slurry (Clarke 1975). Alternatively, slabs of fracturing or spalling rock can be individually grouted or pinned back into place (Kennedy 1979;

Sullivan 1978; Walston and Dolanski 1976), while loose and fragmented rock can be stabilized in a ground polyester resin (Wainwright 1985). Both methods have been used successfully to stabilize rock art surfaces.

Stabilization of Pigments

Understanding the factors which affect the bond may enable the stabilization of pigments through alteration of the relationships of the system rather than relying on synthetics for stabilization (Clarke 1976). The bonding relationship has been explored by Myers and Taylor (1974), Wainwright (1985) and Wainwright and Taylor (1978), who are hopeful that microanalysis will reveal causes of deterioration and methods of conservation. Presently, however, no effective measures are known which actually improve bonding relationships.

Restoration

True restoration of rock art, that is, the effort to restore it to its original condition (Brunet and Vidal 1984), has been undertaken only rarely. Restoration to date has consisted only of efforts to eliminate graffiti. Swartz (1981b) has questioned the need for restoration of any sort, including the removal of graffiti. He feels the cosmetic improvements of restoration do not justify the risks involved. In addition, Swartz (1981b) comments that a certain amount of subjectivity is involved in the actual identification of graffiti, as well as in assessing its degree of historical significance. Clarke (1978b), on the other hand, feels that removing graffiti minimizes the risk of future vandalism. As well, some graffiti is so intrusive that the obvious choice is to remove it.

The removal of graffiti has been undertaken frequently. Spray paint has been removed from a number of pictograph sites using methylene chloride-based paint removers (Clarke 1975, 1978b; Kennedy 1979; Wainwright 1985), but these substances should never be used without first testing their reaction to the pigments and the substrate. Charcoal and chalk graffiti have been removed using both solvents and glass-fibre brushes (Brunet and Vidal 1984; Clarke 1978b). Removal of incised graffiti is more difficult. Light scratches can be brushed off and stained with soils to match the surrounding rock (Clarke 1978b), but more radical methods are required for deeply incised graffiti. Clarke (1975) has described a method whereby the area surrounding a vandalized petroglyph was chipped away and then "weathered" with hydrochloric acid to match the untouched rock surface. When the graffiti actually crossed the glyphs, Clarke (1975) filled the incisions with crushed limestone and cement. Another method was developed by Elvidge and Moore (1980) for desert varnish petroglyphs in the American southwest, whereby an artificial desert varnish was precipitated onto sandstone surfaces where graffiti had been chipped around glyphs. Experimentation with solutions allowed good colour matches and precise boundaries.

In certain cases, limited restoration is a beneficial measure, but it should be stressed that restoration should be approached conservatively and only after careful analysis of the benefits and risks. The work should be done by qualified conservators, and, as always, care must be taken that no relevant data are lost during restoration efforts.

PRELIMINARY RECOMMENDATIONS REGARDING THE INVENTORY, DOCUMENTATION, MANAGEMENT AND CONSERVATION OF ALBERTA ROCK ART

Until a survey of all Alberta rock art has determined the exact causes of deterioration affecting each site, it is difficult to make specific recommendations for their conservation. Nonetheless, based on existing information and considering the research which has been completed to date elsewhere in the world, it is possible to make a number of general recommendations. The following recommendations point out possible approaches and alternatives that can be taken for the overall management and conservation of Alberta rock art and outline methodologies that might apply to the conditions of the various sites.

INVENTORY

The current status of the Alberta rock art inventory is summarized in Appendices 1 and 2 at the end of the paper. From these lists, it can be seen that many of the sites are unconfirmed and lack detailed information concerning their condition and description. These data are very important for determining the protection priority of each site, and a complete survey of Alberta sites should be undertaken to compile and update condition and description information.

The rock art of Writing-On-Stone was surveyed by Keyser (1977), but a number of steps must be taken to update the inventory. Keyser confirmed the existence and status of 59 of the 71 sites documented in Archaeological Survey of Alberta site inventory forms (Appendix 1), and his recommendations for the protection priority of each these sites has been retained (Keyser 1977). Eleven of the 12 sites not recorded by Keyser are poorly documented and may have been duplicated in the site forms. Although the existence of these sites is unlikely, an attempt should be made to confirm their status.

The only exception to the 12 unconfirmed sites is DgOw-36, which was reported after Keyser completed his report and has since been recorded photographically (Archaeological Society of Alberta 1980). A number of other sites which have not been reported in the Archaeological Survey of Alberta site inventory may be located in the same small coulee as DgOw-36 (see Archaeological Society of Alberta 1980). Keyser also feels that there likely are several more undocumented sites in the park, as well as along the Milk River from Verdigris Coulee to the park (personal communication 1988). A systematic survey of the entire area by professional archaeologists is a must, and the inventories of DgOw-32 and the Weir site (to which Keyser could not gain access) should be completed if at all possible.

Twenty-five additional rock art sites have been reported outside of Writing-On-Stone. Of these, only 13 are confirmed sites (see Appendix 2). Each of these sites has been assigned a protection priority rating in the inventory based on existing information about their condition and description, but all should be revisited to confirm their actual status. An additional four pictographs (EaPk-38, EaPk-61, EbPl-2 and EjPl-1) are unconfirmed but highly probable sites. These sites should be relocated and confirmed, and each should be assigned a protection priority rating based on their condition and description. The remaining eight sites are unconfirmed and range from possible to highly unlikely.

DOCUMENTATION

Many of the rock art sites in Alberta have been at least partially documented. Unfortunately, documentation is incomplete, inconsistent and scattered through a number of institutions. The inconsistency of the record was best described by Dewdney (1979), who demonstrated substantial differences in the reproductions of the same Alberta pictographs by different artists. In addition, Dewdney (1979) was concerned about the lack of adequate and consistent published reproductions of Alberta pictographs and about misleading conclusions which might result from examination of the existing record. These factors make the need for a comprehensive documentation programme imperative.

The rock art of the Writing-On-Stone area, with the exception of those sites mentioned in the inventory section, has been documented by Keyser (1977) with written descriptions and ink tracings on acetate. For the most part, this information is consistent and reliable; however, some inconsistency has been noted in the tracings, and relationships of the tracing sheets to each other is often unclear. A universal site grid would help in correcting this problem, and it would be useful to re-check the tracings in the field. Furthermore, archival-quality copies of the tracings should be made to ensure their survival.

It appears that the only adequately recorded sites outside of Writing-On-Stone are the Head-Smashed-In petroglyphs (DkPj-22 and 23; Brink et al. 1986). If these petroglyphs are to be incorporated into the Head-Smashed-In interpretation programme, it may be necessary to re-examine the documentation. The remaining confirmed sites are all pictographs, and many have not been recorded adequately. In the early 1960s, Dewdney made accurate tracings and took photographs of all the rock art sites known in Alberta at that time, but this documentation needs to be updated.

Stereophotogrammetry has been shown to be an extremely accurate method of recording petroglyphs. It can provide a consistent record to back up tracings and may permit future three-dimensional reproduction of entire panels. While descriptions of the glyphs and boulder substrate suggest that stereophotogrammetry could be difficult at the Head-Smashed-In petroglyphs, the feasibility study by Bell and Letellier

(1983) indicates that this would be an effective way of recording many of the sites at Writing-On-Stone. The soft sandstone substrate and high public exposure make the rock art at Writing-On-Stone some of the most threatened in Alberta. Stereophotogrammetry would permit the maintenance of a precise record for future study and reference.

Nine of the high priority sites at Writing-On-Stone include pictographs. Effective stereophotogrammetric recording of these pictographs would require the refinement of the technique (Bell and Letellier 1983), and this route should be pursued. Whenever stereophotograms are not feasible, tracings and a professional photographic record should be maintained.

The nature of the rock art substrate at Writing-On-Stone makes casting the panels out of the question. Keyser chose other recording techniques over casting, stating that it was important that "no foreign substances such as plaster, paint, resin, latex, or water come in contact with the often fragile surfaces on which the glyphs are located" (1977:11). In the early 1980s, limited casting was planned for the petroglyphs at Writing-On-Stone, and the Canadian Conservation Institute was consulted to determine the safety of this plan. The results of this study indicated that moulding would risk damage to the panels, and the casting plan was abandoned (Wainwright, personal communication 1988). The Head-Smashed-In petroglyphs may be sufficiently stable to allow casting, but this measure should be approached with care.

Complete documentation also includes the collection of all data which may be of use in dating, such as the presence and condition of weathering, patination and surface deposits, as well as the analysis of pigment samples. A deterioration analysis, discussed in the following section, also can be included in the documentation of sites. In order to facilitate the complete documentation of sites, a standard recording system and set of criteria must be developed, and any new sites which may be inventoried through further survey work should be documented according to those standards. Finally, copies of all records should be curated and kept on file in a single, safe location, such as the Archaeological Survey of Alberta or Provincial Archives.

MANAGEMENT

A comprehensive management plan for Alberta rock art, separate from a general archaeological resource policy, does not exist at this time. While the Historical Resources Act provides sufficient legal protection for all sites in Alberta, specific policies are required for the special needs of rock art sites. Presently, only Writing-On-Stone Provincial Park and, to a lesser extent, Head-Smasned-In have active management policies designed to control public interaction with the rock art. Some suggestions for stepped-up management of all Alberta rock art sites are discussed below.

The significance and value of the rock art in the Writing-On-Stone area is well recognized, and the current management policy for Writing-On-Stone Provincial Park takes this onto account. However, this policy does not protect the large number of sites outside the park boundaries, and the policies for sites within the park suffer from a number of deficiencies.

The major problems with the rock art management at Writing-On-Stone include access, supervision and interpretation. A portion of the park is designated a Provincial Historical Resource and access to the panels in this area is restricted; however, extensive supervision of the restricted sites exists during the summer months only. As a result, important sites are accessible during much of the year. Due to minimal overall supervision, a large number of opportunities exist for a determined individual to inflict serious and irreparable damage. Additionally, despite its high profile, there are no permanent interpretive facilities at the site.

The extent and importance of Writing-On-Stone suggests that management and interpretive policies could be enhanced significantly. A permanent interpretive presence is needed, and a greater emphasis should be placed on the prevention of vandalism through appropriate signing, education and supervision. Site access restrictions should be strongly enforced and should be extended to include all important panels not presently protected. The use of fencing to protect sites has a number of drawbacks, as discussed previously, and requires supervision to be fully effective, but in some cases it may be the only immediate alternative.

For example, the battle scene (DgOv-81) was not included in the restricted area of the park and therefore was at great risk. A decision was recently made to fence off the panel in the absence of better alternatives (Figure 24). Fencing was originally planned for all of Writing-On-Stone, but this has been put on hold. Before further fencing is undertaken, it would be wise to undertake a study of the potential damage and benefits from this action.

The unprotected sites outside of the park boundaries include the extensive sites of DgOw-29 and 32. Although their locations are not broadly publicized, they are known locally and are easily accessible to those determined to find them. These sites are subject to considerable real and threatened vandalism, which already has gone far beyond graffiti. Parts of a number of panels have been removed with saws (Keyser 1977), and several sections are known to be in private collections (Archaeological Society of Alberta 1980). In addition, some sites may be threatened by extensive damage from cattle.

The best possible scenarios for the protection of the rock art now outside park boundaries would be their inclusion within the park system, designation as a Provincial Historical Resource or incorporation into an active interpretation programme administered by Alberta Culture and Multiculturalism. Barring these options, possible alternatives could be exploring greater cooperation with landholders and the introduction of site wardens. A voluntary system, along the lines of the Rural Crime Watch model, may also be effective. Providing interpretive and cautionary signs in locations where it is certain that visitors have already discovered the rock art may also reduce the risk of vandalism. Fencing around sites affected by cattle is also necessary, but must take into account the resulting increase in visibility. Finally, the protection priority of each site should be taken into consideration, especially if management resources are limited.

The public profile of most of the rest of the rock art sites in Alberta is much lower than the profile of those at Writing-On-Stone, and they are much less extensive in size and content. Many are extremely important from a scientific perspective, however, and the need for a management plan for these sites has been recognized for some time (Brink 1980). It is unlikely that funding for these sites will ever be

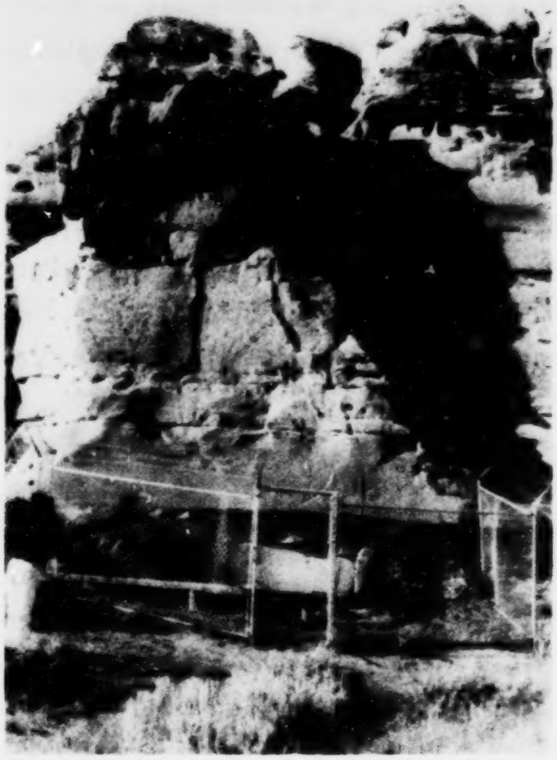

Figure 24. Fence erected around the battle scene at DgOv-81 as an immediate measure to protect this important petroglyph panel.

comparable to Writing-On-Stone or that permanent, on-site supervision is feasible for most. On the other hand, a number of low-cost management steps are possible and, indeed, imperative. Where necessary, open or closed management policies which recognize the degree of public accessibility and knowledge of each site should be instituted. This means that high profile sites should have at least minimal supervision and interpretation, while measures which restrict information about and access to low profile sites should be instituted.

Sites where an open policy should be followed because of their high profile and high protection priority include DkPj-22 and 23, EgPt-1, EgPu-4 and EePm-3. While the Head-Smashed-In petroglyphs (DjPk-22 and 23) are not important for their intrinsic quality, they have a high priority since they are the only confirmed Alberta petroglyphs outside of Writing-On-Stone and because of their inclusion within a World Heritage site. These petroglyphs are stable and could be incorporated safely into the interpretive programme provided that adequate supervision in maintained. The Grotto Canyon site (EgPt-1) encompasses a large number of unique, scientifically significant pictographs which have a high priority rating. Unfortunately, they are very well known and highly threatened. Presently a sign is posted at the entrance to the canyon which describes the pictographs and encourages hikers to search for them, while little attempt is made to protect them from the increased threat of vandalism. This sign should be removed and/or information should be posted emphasizing the destructiveness of any contact with the surface of the rock art. Supervision of the site should be significantly increased, which would be fairly easy in that the site is administered as part of Kananaskis Country. The Spray Lakes pictographs (EgPu-4) are also given a high priority because they cover an extensive area at a heavy traffic site. Some vandalism has been reported there already, and more is likely to occur. They require essentially the same management as the Grotto Canyon pictographs. Finally, the Okotoks Erratic pictographs (EePm-3) are now of poor quality, and rate only a medium priority. However, their inclusion within a Provincial Historical site suggests that they would be valuable in any future interpretation of the site. This interpretation should emphasize the preservation of the pictographs.

Closed policies should be followed for most of the remaining confirmed sites. The relatively undisturbed Cline River pictographs (FaQf-1) are in an isolated location within the Sheep River Wilderness area and have a high protection priority. Other than occasional hikers and hunters, few people are aware of this site, and there is no need for increasing its profile. These pictographs already have been damaged by fires built under the overhang where they are located and placing a discrete sign immediately beside the site would make campers aware of damage caused by fires and encourage the appreciation and preservation of pictographs. The Zephyr Creek pictographs (EcPp-1) are very significant and quite extensive. Although the site has not yet been appreciably vandalized (Brink, personal communication 1988), an important thunderbird morph has been partially hacked off by a souvenir hunter. In addition, their location near a Kananaskis Country trail means that the condition of the pictographs is threatened by future discovery and vandalism.

Again, their location should be kept secret, and a discrete cautionary sign placed at the site where only those who have already discovered the pictographs will see it. Hopefully, this will prevent damage, at least until the profile of the site increases.

Two sites which are poorly known are the 25 Ranch (EbPl-3) and Pekisko (EcPm-1) pictographs, both of which are significant for their unique representations and rate a high priority. Both are located in populated areas and, while the former is still in excellent shape despite some recent damage to the surrounding rock, the latter is heavily vandalized. Both are threatened by continued vandalism and should be discretely signed in the manner already described.

Based on existing information, management beyond a closed information policy is probably not necessary for sites other than those listed above. This situation may change as additional information becomes available or new sites are discovered, and a structure should be in place which can accommodate these changes in status. In particular, a careful eye should be kept on the effects of management policies already implemented. The conditions and status of many sites may change over time, and management should be adjusted accordingly. Additionally, policies at some sites may be found to be ineffective, and periodic checks on sites should be made to note whether further steps may be needed. Overall, the importance of management cannot be denied, and without management the effectiveness of any conservation measure is greatly diminished.

CONSERVATION

It has been stressed a number of times that conservation cannot proceed until an analysis of deterioration factors has been completed for all Alberta rock art sites. However, a number of general recommendations are given below and in Table 6.

The petroglyphs and pictographs at Writing-On-Stone have been executed on a substrate of moderately soft sandstone. Most of the rock art consists of deeply incised petroglyphs, although some glyphs are only lightly scratched, and a handful of the morphs are chalked or painted. Although differing in execution, all of the rock art at Writing-On-Stone

Table 6. Summary of preliminary recommendations for Alberta rock art sites.

Writing-On-Stone

Inventory:

1. Attempt survey of 12 unconfirmed sites
2. Resurvey DgOw-36 area
3. Finish inventory of DgOw-32 and Weir site

Documentation:

1. Inspect existing tracings and check for accuracy
2. Make tracings of all new sites
3. Make archival-quality copies of all tracings
4. Record all high priority sites with photography and stereophotogrammetry
5. Develop standard documentation format to record all physical aspects and deterioration factors

Management:

1. Provide enhanced, year-round supervision
2. Provide a permanent interpretive presence
3. Restrict access to as many of the sites as possible
4. Study benefits and drawbacks of fences and shelters
5. Incorporate other main sites in park boundary and expand area designated as provincial historical resource site
6. Construct livestock fences where needed at sites outside of the park
7. Erect cautionary and interpretive signs

Conservation:

1. Initiate a deterioration analysis at a number of selected sites, utilizing geologists, geomorphologists, conservators, etc.
2. Undertake a pigment analysis at selected sites
3. Begin a limited programme of erosion monitoring, with stereophotogrammetry and measuring devices, with the assistance of geomorphologists
4. Initiate stabilization of DgOv-78
5. Research methods for future water reduction at all sites

Remaining Alberta Sites

Inventory:

1. Determine status, description and condition of all confirmed sites
2. Attempt to locate and confirm status of highly probable sites (EaPk-38, EaPk-61, EiPn-1) and unlikely sites (EbPk-6, EbPl-2, EePm-2, EhPl-2, EjPl-1, HgOv-54)

Documentation:

1. Collect and curate all existing documentation
2. Produce consistent, colour-matched tracings of all confirmed sites

Table 6. continued.

	3. Record all sites with professional-quality colour and black and white photography
	4. Make separation negatives and archival copies of tracings
	5. Develop standard documentation format to record all physical aspects and deterioration factors
Management:	1. Include DkPj-22 and 23 into interpretation programmes, with suitable supervision
	2. Review signing at EgPt-1 and EgPu-4 and increase supervision and interpretation
	3. Include EePm-3 in future interpretation
	4. Provide closed management and discrete signing at remaining confirmed sites
	5. Explore access restriction, landowner cooperation, voluntary supervision, etc. where needed
	6. Consider designations as provincial or registered historical sites
Conservation:	1. Initiate a deterioration analysis based on success of Writing-On-Stone programme
	2. Stabilize rock mass at EcPp-1 and make sample collection for analysis and dating
	3. Explore erosion monitoring programme
	4. Attempt microanalysis of EgPt-1 surface deposit and pigment at EcPp-1
	5. Attempt removal of smoke blackening at FaQf-1
	6. Research methods for future water reduction at all sites

is subject to similar deterioration pressures. Keyser (1977) identified damage by humans as the major threat to the rock art of Writing-On-Stone, but this cannot be controlled by conservation. Natural erosion, on the other hand, may be reduced by conservation measures, and the role of this deterioration factor has not been examined adequately.

Keyser, in the first serious attempt at identifying the causes of natural deterioration at Writing-On-Stone, concluded that "exfoliation and breakage of the surface, exposure to rain and run-off, and sandblasting" were the major agents of deterioration (1977:197). This conclusion is based on casual observation and little actual experimentation. Keyser (1977) goes on to suggest that the rates of natural deterioration at Writing-On-Stone are probably relatively slow.

This conclusion is based on comparison of photographs taken in 1895 and 1976, and Keyser acknowledges that the actual rates of erosion were impossible to determine. He suggests that rates of erosion at a number of panels should be monitored in order to determine the actual extent of natural deterioration.

Even if rates of deterioration are slow, natural agents are still a cause for concern. For example, the advanced state of spalling at DgOv-78, the exposure to the elements of DgOv-88 and the very faint nature of DgOv-81 indicate that a serious and immediate look should be taken at all the Writing-On-Stone sites to determine the possible agents of natural deterioration and the extent of their effect. At present, a conservation plan for Writing-On-Stone should consist of a deterioration analysis, an erosion study and some immediate conservation measures. A similar programme should be implemented for several other confirmed sites in Alberta. Only after these steps can concrete, long-term conservation plans be drawn up.

Deterioration Analysis

The immediate priority at Writing-On-Stone is to determine exactly which natural processes are deterioration factors. Experience elsewhere in the world has shown that most rock art deterioration has its origin in water-based processes, and this is a logical place to begin at Writing-On-Stone. All three processes identified by Keyser (1977) as major natural agents of deterioration are probably related to the action of water. Exfoliation can be assumed to be the result of frost action (or, less likely, the result of subfluorescence of salts), while solution and mechanical weathering probably relate to rain and run-off. Breakage of the surface may refer to a number of processes, including fracture along bedding planes, erosion of fault joints or frost action. Sandblasting is a vague term referring to the action of wind-blown particles. The role of the wind in this sense is probably relatively minor, and the mechanical erosion arising from this process likely removes only particles already loosened by water-based processes.

To determine the exact role of each deterioration process, a multidisciplinary approach should be taken, with information provided by geologists, geomorphologists, hydrologists, biologists and park planners. A small number of representative sites should be intensively examined to identify all agents of deterioration. Once these agents have been identified, a set of criteria can be drawn up to identify quickly the presence and extent of factors affecting other sites. The roles of some specific processes and factors which should be examined have been summarized in Table 5. A number of factors which affect only pictographs should be examined as well. For example, a pilot study examining the composition of the pigments and the pigment-rock binding relationship of some of the more important pictograph panels would be helpful to determine future conservation.

Potential sites for pilot studies of erosion rates were proposed by Keyser (1977; see Table 7). As these sites provide examples of all types of rock art at Writing-On-Stone, as well as a cross section of deterioration conditions, they are also well suited for the initial deterioration analysis. Most also have a high protection priority. With the completion of the initial deterioration analysis and the deterioration identification criteria established, the remainder of the sites can be examined.

The Writing-On-Stone programme could serve as a model for the deterioration analysis of other sites in Alberta. Most of the problems would have been worked out beforehand, although many of the details of the analysis and monitoring would have to be adjusted to the specific conditions of each site. In particular, differences in the rock substrate must be taken into account, as the rock art of Writing-On-Stone and the foothills sites is often executed on sandstone, while the rock art at Rocky Mountain sites is usually found on limestone or dolomite. Another difference is deterioration from biological growths. This is not a problem at Writing-On-Stone but is involved in the deterioration at several of the mountain sites. The high profile, high protection priority sites where the programme would be useful are DjPp-1, EgPt-1, EgPu-4, EcPp-1, EbPl-3, EcMp-1, EePm-3 and FaQf-1. The remaining confirmed sites are either relatively stable (e.g., DkPj-22 and 23), or they are of low priority. Again, this situation may change as additional information becomes available.

Table 7. Recommended sites for deterioration analysis at Writing-On-Stone.

Pictographs	Petroglyphs
DgOv-2 panel 1	DgOv-2 panel 2
DgOv-57	DgOv-2 panel 5
DgOv-78	DgOv-2 panel 11
DgOv-85	DgOv-76
DgOv-19	DgOv-77
DgOw-20	DgOv-81
	DgOv-84
	DgOw-21
	DgOw-28

Erosion Study

The identification of deterioration factors does not necessarily determine the priority with which they must be dealt. In other words, rates of erosion should be determined for each factor so that their priority for reduction can be established. For instance, although the rate of surface erosion at Writing-On-Stone appears to be quite slow, this should be confirmed empirically in order to assess the expediency of surface consolidation. It may be possible to established general deterioration and surface erosion rates using a number of techniques, including stereophotogrammetry and erosion meters. Since four Writing-On-Stone panels already have been recorded by stereophotogrammetry, a pilot study of the applicability of this technique in determining erosion rates at these sites is recommended. Again, geomorphologists can provide assistance in setting up this project, as well as in designing an appropriate erosion monitoring programme using other equipment already developed for this purpose. In many cases, however, the factors of deterioration may need to be identified before rates can be tested, and, as new information becomes available, the monitoring programme can be expanded and adjusted. An erosion study is recommended for the sites listed in the proceeding section.

Immediate Conservation

Despite the nearly complete lack of deterioration information, the conditions at a number of sites are known well enough to warrant immediate conservation attention. For example, site DgOv-78 at Writing-On-Stone is in immediate danger of spalling off, and a careful attempt at grouting this panel back into place seems warranted. If grouting is not possible, removal of this panel may have to be considered. In addition, the thunderbird at DgOv-88 is deteriorating rapidly due to exposure and should be sheltered in some way.

Outside of Writing-On-Stone, the Grotto Canyon pictographs (EgPt-1) are subject to the formation of a surface deposit, and this layer may eventually obscure the already faint pictographs. The formation, composition and effect of this layer should be examined by microanalysis. It is important to know if this layer has a detrimental effect on the pictographs and, if so, what can be done about it. Again, the assistance of the Canadian Conservation Institute could be obtained for this analysis. Furthermore, the potential this layer has for dating purposes should be explored before any alteration takes place.

The Zephyr Creek pictographs (EcPp-1) are in generally good condition themselves, but the rock mass is badly fractured and falling down (Figure 25). It may be possible to stabilize this slope with grouting and pinning. As well, the pieces of rock pigment which have already fallen should be collected. Although it is unlikely that they could be pieced back together, if the pigment contains a protein vehicle, they may be suitable for accelerator dating.

Finally, the Cline River pictographs (FaQf-1; Figure 26) have been damaged by fire and smoke. Heat may have encouraged spalling and might be corrected with grouting, while soot might be removed by gentle use of a glass fibre brush.

Future Conservation

At Writing-On-Stone, surface water erosion is likely a major factor in the deterioration of both petroglyphs and pictographs. As a result, measures to reduce surface water and its effects are needed. Placing silicone drip lines above all the panels is probably the most effective method of achieving this reduction. Ground water is also a likely

Figure 25. The pictographs at Zephyr Creek.

Figure 26. The Cline River pictographs.

deterioration factor, but the subfluorescence of salts, spalling and other effects resulting from ground water are more difficult to control. Improving drainage above the panels and sealing cracks and piping channels may be effective.

At present, consolidation of sandstone with chemicals is such an experimental, expensive and generally impractical method that it is almost certainly of no use in preventing water damage in the immediate future. Other experimental methods, such as strengthening the rock-pigment bond or precipitating surface mineral deposits, may have some future potential but are not feasible at present. The completion of a deterioration analysis may alter this situation. In some cases, shelters may be highly desirable but inhibited by their expense. Cracked, fractured, spalling or collapsing panels may be saved with careful grouting and pinning.

The restoration of panels damaged by graffiti is not recommended as a rule. In some cases, the graffiti has historical significance, and, in others, the distinction of graffiti from actual rock art can be tenuous. Finally, restoration runs the risk of being just as obtrusive as the graffiti or of altering the rock art. Only in cases of obvious vandalism and where the restoration technique has been demonstrated to be infallible should restoration be considered.

These conservation measures for the future apply equally to the rock art outside of Writing-On-Stone. All the high protection priority sites discussed earlier deserve a detailed examination and implementation of conservation measures wherever possible. Only additional research and fieldwork will provide more substantial directions for the conservation of Alberta rock art.

CONCLUDING REMARKS

The purpose of this paper has been twofold: first, to compile in one place a review and summary of major rock art conservation practices on a global scale and, second, to provide recommendations for rock art conservation in Alberta. It is clear that despite a respectable amount of literature, rock art conservation everywhere is still experimental in nature, and each site's specific natural and cultural characteristics need to be fully understood before conservation measures are applied.

The many petroglyphs and few pictographs at and near Writing-On-Stone Provincial Park are obvious priorities for protection and conservation. While permanent conservation may not be possible at Writing-On-Stone or at the other rock art sites in Alberta, precautionary approaches should be taken. Indeed, at the time of writing this paper (early summer 1988), we are pleased to note that Alberta Recreation and Parks and Alberta Culture and Multiculturalism have agreed to jointly oversee a preliminary conservation study at Writing-On-Stone.

ACKNOWLEDGEMENTS

The authors would like to thank Ian N.M. Wainwright of the Canadian Conservation Institute for providing detailed and up-to-date information on rock art conservation efforts in Canada, as well as information on conditions affecting the rock art of Writing-On-Stone. The sections dealing with Writing-On-Stone and much of the inventory of Alberta rock art would not have been possible without the admirable and comprehensive research undertaken by James D. Keyser, now with the USDA Forest Service in Portland, Oregon. Jack Brink of the Archaeological Survey of Alberta provided assistance and reviewed previous versions of this manuscript.

Appendix 1. Rock art of Writing-On-Stone area.

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOv-2	confirmed	pictograph (panel 1)	3 anthromorphs, tool grooves	van 1, nat 1	medium
		petroglyph (panel 2)	anthromorphs, weapons, 2 zoomorphs, abstracts	van 1, nat 1	medium
		petroglyph (panel 3)	anthromorph	van 5, nat 0	low
		petroglyph (panel 4)	2 anthromorphs, tool grooves	van 5, nat 0	medium
		petroglyph (panel 5)	2 anthromorphs, zoomorph	van 5, nat 0	high
		petroglyph (panel 6)	anthromorph, horse	van 0, nat 2	medium
		petroglyph (panel 7)	6 anthromorphs, 2 horses, 1 weapon, tool grooves, tally marks, abstracts	van 5, nat, 0	high
		petroglyph (panel 8)	2 anthromorphs, tool grooves	van 2, nat 1	medium
		petroglyph (panel 9)	4 anthromorphs, horse, abstract, tool grooves	van 2, nat 4	high
		petroglyph (panel 10)	2 anthromorphs, horse	van 1, nat 0	medium
		petroglyph (panel 11)	anthromorph	undisturbed	low

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOv-2	confirmed	petroglyph (panel 12)	2 anthromorphs	van 4, nat 0	medium
		petroglyph (panel 13)	5 anthromorphs, abstracts, tool grooves	van 2, nat 1	high
		petroglyph (panel 14)	12 anthromorphs, 4 zoomorphs, abstracts	van 4, nat 0	high
		petroglyph (panel 15)	2 anthromorphs, weapon, tool grooves, abstracts	van 4, nat 0	medium
		petroglyph (panel 16) pictograph (?)	8 anthromorphs, 4 horses		
		petroglyph (panel 17)	27 anthromorphs, 3 zoomorphs, 4 horses	van 5, nat 1	high
		petroglyph (panel 18)	6 anthromorphs, 5 horses, 2 tipis, abstracts	van 5, nat 2	high
		petroglyph (panel 19)	anthromorph, 2 horses, abstracts	van 0, nat 1	medium
		petroglyph (panel 20)	2 anthromorphs, tool grooves	van 1, nat 1	low
		petroglyph (panel 21) pictograph	4 anthromorphs, horse, abstracts, tool grooves, abstracts, tally marks	van 1, nat 1	high

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOv-2	confirmed	petroglyph (panel 22)	4 anthromorphs, weapon, tool grooves	van 2, nat 1	medium
		petroglyph (panel 23)	5 anthromorphs, 3 horses, zoomorph, 2 weapons, abstracts	van 4, nat 0	high
		petroglyph (panel 24)	4 anthromorphs, 2 horses, 2 gallows, 27 tipis, wagon, abstracts	van 2, nat 5	high
		pictograph (panel 25)	anthromorph, 3 abstracts	van 0, nat 1	medium
		petroglyph, (panel 26)	36 anthromorphs, 36 horses, weapons, tipis, bird, 2 zoomorphs, abstracts	van 5, nat 0	high
DgOv-3	confirmed	petroglyph	20 anthromorphs, weapons, zoomorph, abstracts	van 4, nat 3	high
		pictograph	tally marks		
DgOv-9	confirmed	petroglyph	14 anthromorphs, 6 zoomorphs, 2 tipis	van 5, nat 0	high
DgOv-11	marginally probable	petroglyph (?)	unknown	unknown	unknown
DgOv-27	marginally probable	petroglyph (?)	2 anthromorphs (?), horse (?), zoomorphs (?)	partially disturbed (?)	unknown
DgOv-42	confirmed	petroglyph	2 anthromorphs, 4 zoomorphs, abstracts, tool grooves, tally marks	van 1, nat 0	medium
		pictograph	anthromorph		

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOv-43	confirmed	petroglyph	4 anthromorphs, horse, tipis, tracks, abstracts	van 2, nat 1	medium
		pictograph	anthromorph, weapons, abstracts, tracks		
DgOv-44	confirmed	petroglyph	tool grooves, tally marks	undisturbed	low
DgOv-45	confirmed	petroglyph	2 anthromorphs, 2 tipis, 2 horses, abstracts	van 0, nat 1	high
DgOv-46	confirmed	petroglyph	zoomorph, 4 abstracts	undisturbed	low
DgOv-47	marginally probable	petroglyph (?)	recent copy (?)		
DgOv-49	confirmed	petroglyph	13 anthromorphs, 18 horses, tipi, abstracts	van 3, nat 1	medium
DgOv-50	confirmed	petroglyph	2 anthromorphs, 1 horse	van 2, nat 0	low
DgOv-51	confirmed	petroglyph	horse	van 0, nat 1	low
DgOv-52	confirmed	petroglyph	anthromorph, horse, tipi	van 2, nat 0	low
DgOv-53	confirmed	petroglyph	2 anthromorphs, weapon, tally marks	undisturbed	medium
DgOv-54	confirmed	petroglyph	3 anthromorphs, 2 horses, weapon	van 3, nat 0	low
DgOv-55	confirmed	petroglyph	12 anthromorphs, 4 horses, abstracts	van 0, nat 2	medium

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOv-56	confirmed	pictograph	2 anthromorphs, 3 horses	van 0, nat 3	medium
DgOv-57	confirmed	pictograph	13 anthromorphs, 4 horses, 4 tipis, weapons, abstracts	van 0, nat 1	high
DgOv-58	marginally probable	pictograph (?)	unknown	unknown	unknown
DgOv-59	confirmed	petroglyph	4 anthromorphs, zoomorph, abstracts	van 0, nat 1	medium
DgOv-60	confirmed	petroglyph	24 anthromorphs, 26 horses, weapons	van 1, nat 1	high
DgOv-63	confirmed	petroglyph	5 anthromorphs, 2 horses, weapon, abstracts	van 3, nat 1	high
DgOv-64	confirmed	petroglyph	6 anthromorphs, horse, zoomorph, tool grooves, tally marks	undisturbed	medium
DgOv-65	confirmed	petroglyph	zoomorph	undisturbed	high
DgOv-66	confirmed	petroglyph	zoomorph, tool grooves	van 2, nat 0	high
DgOv-67	confirmed	petroglyph	abstract	van 0, nat 1	low
DgOv-68	marginally probable	petroglyph (?)	anthromorph (?), abstracts (?)	unknown	unknown
DgOv-69	confirmed	petroglyph	3 anthromorphs, 2 horses	van 2, nat 1	medium

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOv-71	marginally probable	petroglyph (?)	unknown	unknown	unknown
DgOv-73	confirmed	petroglyph	anthromorph, 2 horses, tool grooves, tally marks	van 3, nat 0	low
DgOv-74	confirmed	petroglyph	7 anthromorph, travois, abstracts	van 2, nat 0	medium
DgOv-75	confirmed	petroglyph	anthromorph, horse, zoomorph	van 0, nat 4	high
DgOv-76	confirmed	petroglyph	4 anthromorphs, tracks, tool grooves, tally marks	undisturbed	high
DgOv-77	confirmed	petroglyph	anthromorph, 5 zoomorphs, tracks, tool grooves, tally marks, abstracts	van 0, nat 1	high
		pictograph	abstracts		
DgOv-78	confirmed	pictograph	4 anthromorphs, horse, 5 weapons, tipi, 7 travois, 4 tracks, abstracts	van 1, nat 1	high
DgOv-79	confirmed	petroglyph	5 anthromorphs, 2 horses, tipi, abstracts	van 3, nat 1	medium
		pictograph	3 anthromorphs, 2 horses, 2 zoomorphs, abstracts		
DgOv-80	confirmed	petroglyph	9 anthromorphs, 5 horses, 3 tipis, tracks	van 3, nat 0	high

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOv-81	confirmed	petroglyph (battle scene)	115 anthromorphs, 30 tipis, 47 weapons 12 horses, 6 travois, abstracts	van 3, nat 0	high
DgOv-82	confirmed	pictograph	abstracts	van 0, nat 1	low
DgOv-83	confirmed	pictograph	2 anthromorphs, abstracts	undisturbed	medium
DgOv-84	confirmed	petroglyph	4 horses, abstracts	van 1, nat 0	high
DgOv-85	confirmed	petroglyph pictograph	2 anthromorphs, 2 horses anthromorph, abstracts	van 3, nat 1	high
DgOv-86	confirmed	petroglyph,	2 anthromorphs, abstracts	undisturbed	medium
DgOv-87	confirmed	petroglyph	3 anthromorphs, 2 horses	van 3, nat 0	medium
DgOv-88	confirmed	petroglyph pictograph	17 anthromorphs, 3 zoomorphs, abstracts, tracks thunderbird, abstracts	undisturbed (?)	high
DgOv-89	confirmed	petroglyph	6 anthromorphs, horse, zoomorph	van 5, nat 0	low
DgOv-90	confirmed	petroglyph	anthromorph, tool grooves	van 2, nat 0	medium
DgOv-91	confirmed	petroglyph	horse	van 3, nat 0	low
DgOv-92	confirmed	petroglyph	tool grooves	undisturbed	low

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOw-8	marginally probable	petroglyph (?)	4-5 tipis (?)	unknown	unknown
DgOw-9	marginally probable	petroglyph (?)	unknown	unknown	unknown
DgOw-19	confirmed	pictograph	8 horses, 7 tipis, abstracts	van 0, nat 4	high
DgOw-20	confirmed	pictograph	16 anthromorphs, 13 horses, 4 weapons, abstracts	van 2, nat 1	high
DgOw-21	confirmed	petroglyph pictograph	8 anthromorphs, 9 horses, tracks, 4 zoomorphs abstract	van 2, nat 0	high
DgOw-22	confirmed	petroglyph	11 horses	undisturbed	low
DgOw-23	marginally probable	petroglyph (?)	anthromorph (?), tool grooves (?)	unknown	unknown
DgOw-24	confirmed	petroglyph	6 anthromorphs, 5 abstracts	undisturbed	low
DgOw-25	confirmed	petroglyph pictography	13 horses 2 horses	van 1, nat 2	low
DgOw-26	confirmed	petroglyph	anthromorph, horse, 5 tipis, abstracts	van 3,nat 0	medium

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOw-27	confirmed	petroglyph	16 anthromorphs, 21 horses, 3 zoomorphs, 3 tipis, abstracts, weapon	van 2, nat 0	high
Weir site (Turner)	confirmed	petroglyph	12 anthromorphs (?), 4 zoomorphs (?), 3 weapons (?)	unknown	unknown
		pictograph	abstracts (?)		
Verdigris Coulee					
DgOw-4	marginally probable	petroglyph (?)	unknown	unknown	unknown
DgOw-8	marginally probable	petroglyph (?)	unknown	unknown	unknown
DgOw-28	confirmed	petroglyph	15 anthromorphs, horse, 3 zoomorphs, tool grooves, tally marks	van 2, nat 2	high
DgOw-29	confirmed	petroglyph	73 anthromorphs, 4 horses, 23 zoomorphs, weapons, tracks, abstracts, tool grooves (2 anthromorphs, horse, zoomorph in private collection)	van 4, nat 1	high
DgOw-30	confirmed	petroglyph	14 anthromorphs, 7 horses, tipi, weapons, abstracts (3 anthromorpns, 3 horses now missing)	van 1, nat 0	high

Appendix 1. continued

Borden Number	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgOw-31	confirmed	petroglyph	9 anthromorphs, 6 horses, tipi, tool grooves, tally marks, abstracts (1 horse now missing)	van 1, nat 0	high
DgOw-32	confirmed	petroglyph	35 anthromorphs, 29 horses, 14 tipis, weapons	van 1, nat 0	high
DgOw-35	marginally probable	petroglyph (?)	zoomorph (?)	unknown	unknown
DgOw-36	highly probable	petroglyph (?)	abstracts (?), tool grooves (?)	unknown	unknown

*Damage Scale: 0 - undisturbed, 1 - slight, 2 - moderate, 3 - extensive, 4 - heavy, 5 - extreme
**Protection Priority for conservation, based on site importance and disturbance factors

Appendix 2. Alberta rock art sites outside Writing-On-Stone.

Borden Number	Site Name	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
DgPb-3	Cottonwood Coulee	unlikely	pictograph (?)	unknown	unknown	unknown
DjPp-1	Crowsnest Lake	confirmed	pictograph	zoomorph (?), abstracts (?), anthromorphs (?), tracks (?)	unknown	medium
DkPj-22	Junius Bird	confirmed	petroglyph	zoomorph (?), abstracts, tool grooves, tally marks	undisturbed	low
DkPj-23	Head-Smashed-In	confirmed	petroglyph	abstracts, tally marks	partially disturbed	high
DlPo-63	Racehorse	confirmed	pictograph	7-8 handprints	highly disturbed	low
EaPk-38	Jenkin's Buffalo Jump	highly probable	pictograph	zoomorph, handprint (?), abstracts	partially disturbed (?)	low (?)
EaPk-61	Split Rock	highly probable	pictograph	tracks (?), tally marks, abstracts	highly disturbed (?)	low (?)
EbPk-6	Pine Coulee Cave	possible	pictograph	unknown	unknown	unknown
EbPl-2	Nanton Jump	highly probable	pictograph	tally marks (?), abstracts (?)	highly disturbed (?)	unknown

Appendix 2. continued

Borden Number	Site Name	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
EbPl-3	25 Ranch	confirmed	pictograph	anthromorph, thunderbird, abstracts	undisturbed	high
EcPm-1	Pekisko Cave	confirmed	pictograph	5 anthromorphs (?), thunderbird (?), 5 zoomorphs (?), tally marks (?), abstracts (?)	highly disturbed	high
EcPp-1	Zephyr Creek	confirmed	pictograph	anthromorphs, zoomorphs, thunderbird, tally marks, tracks, abstracts	van 1, nat 2	high
EePm-2	Kopas Ranch	possible	petroglyph	abstract (?)	unknown	unknown
EePm-3	Okotoks Erratic	confirmed	pictograph	anthromorphs (?), zoomorphs (?), 10 weapons (?), tracks (?), abstracts (?)	van 4, nat 4	medium
EgPt-1	Grotto Canyon	confirmed	pictograph	anthromorphs, zoomorphs	van 1, nat 3	high
EgPu-4	Spray Lakes	confirmed	pictograph	anthromorphs, zoomorphs, abstracts	van 2, nat 2	high
EhPl-2	Airdrie Erratic	possible	pictograph	anthromorph (?), thunderbird (?), tally marks (?), abstracts (?)	unknown	unknown

Appendix 2. continued

Borden Number	Site Name	Site Status	Site Type	Description	Damage Level* (vandalism and natural)	Protection Priority**
EiPn-1	Madden Buffalo Jump	confirmed	pictograph	6 anthromorphs (?), tally marks (?), abstracts (?)	van 2, nat ?	unknown
EiPr-1	Cremona	unlikely	petroglyph (?)	unknown	unknown	unknown
EjPl-1	Carstairs	highly probable	pictograph	tracks, tally marks, abstracts	unknown	unknown
EkPj-2	Jack Smith	possible	petroglyph (?)	unknown	unknown	unknown
FePk-2	Ferrybank Canyon	highly unlikely	petroglyph (?)	unknown	unknown	unknown
FaQf-1	Cline River	confirmed	pictograph	anthromorph, zoomorphs, handprints, tally marks, abstracts	van 1, nat 3	high
FhQm-1	Devona Cave	confirmed	pictograph	unknown	undisturbed	low
HgOv-54	Beaver Creek	highly unlikely	pictograph	2 anthromorphs (?), zoomorph (?)	undisturbed	medium (?)

*Damage Scale: 0 - undisturbed, 1 - slight, 2 - moderate, 3 - extensive, 4 - heavy, 5 - extreme
**Protection Priority for conservation, based on site importance and disturbance factors

OBSIDIAN SOURCE STUDY, 1987

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INTRODUCTION

As part of a research programme aimed at determining lithic raw material sources in Alberta, 40 obsidian artifacts were submitted to the senior author for the purpose of identifying the natural sources from which they were made. The submitted artifacts were labelled Alta 1 to 40. The assigned sample numbers, artifact numbers, artifact descriptions and map reference numbers are listed in Table 8. The location of each site within Alberta is shown in Figure 27.

The artifacts showed little variation in colour. Most were black, either opaque or transluscent. Through transmitted light, the less opaque ones appeared grey, green or brown. Banding was common. A large range of variation in size, thickness and surface texture was observed. The quality of the obsidian varied from a highly translucent, smooth, glassy appearance to somewhat grainy. Some samples contained small crystalline inclusions visible to the naked eye. In the experience of the authors, however, neither the colour nor the textural quality of the obsidian are relevant in source characterization.

The smallest and thinnest artifact was Alta 27 (DkPj-1A-75875). At 0.014 g, this retouch flake is the smallest artifact ever identified by the senior author. Fifteen other artifacts (Alta 2-4, 9, 11, 12, 14, 18, 21, 23-25, 29 and 33-36) were judged to be less than 0.5 square centimetres in surface area and under 1 mm in thickness. Large artifacts (Alta 5-8, 10, 15, 20, 22 and 30-32) were analysed using a slightly different instrumental geometry than the rest. Four artifacts (Alta 10, 38, 39 and 40) had been subjected to partially destructive sampling prior

Table 8. Artifacts submitted for XRF analysis.

SAMPLE NO.	ARTIFACT NO.	DESCRIPTION	MAP REFERENCE
Alta 1	GdQp-1-51-18	Flake	1
Alta 2	GdQp-1-81-5	Flake	1
Alta 3	GdQp-1-81-10	Flake	1
Alta 4	GdQp-1-81-10	Flake	1
Alta 5	FfPi-1-204	Flake	2
Alta 6	FfPi-1-416	Flake	2
Alta 7	FfPi-1-1072	Flake	2
Alta 8	FfPi-1-1443	Flake	2
Alta 9	FjPi-29-166-D-12	Flake	3
Alta 10	FhPn-101-4	Flake	4
Alta 11	FjPn-17-8605	Flake	5
Alta 12	FlQs-27-10	Microblade fragment	6
Alta 13	FlQs-30-544-Unit 6-1	Flake	7
Alta 14	EcPp-24-710	Flake	8
Alta 15	EiPr-5-342	Retouched flake	9
Alta 16	EiPr-5-1156	Flake	9
Alta 17	EiPr-5-1157	Flake	9
Alta 18	EiPr-8-2	Flake	10
Alta 19	EiPs-6-85	Flake fragment	11
Alta 20	DhPj-69-2	Awl	12
Alta 21	DjPl-1-288	Flake	13
Alta 22	DjPn-16-735	Flake	14
Alta 23	DjPn-16-12881	Flake	14
Alta 24	DkPj-1-61178	Flake	15
Alta 25	DkPj-1-61453	Flake	15
Alta 26	DkPj-1-61557	Flake	15
Alta 27	DkPj-1A-75875	Flake	15
Alta 28	DkPj-1-Unit 50-1-2	Flake	15
Alta 29	DkPj-1-Unit 50-2-4	Flake	15
Alta 30	DkPj-1-BW-898	Point base	15
Alta 31	DkPj-1-BW-899	Point base	15
Alta 32	DkPj-1-BW-924	Point	15
Alta 33	DkPj-27-Unit 4-3	Flake	16
Alta 34	DkPj-27-Unit 4-4	Flake	16
Alta 35	DkPj-27-Unit 10-3	Flake	16
Alta 36	DkPj-27-Unit 13-2	Flake	16
Alta 37	Blackfoot Grazing Reserve	Flake	17
Alta 38	FlQs-30-544	Flake	7
Alta 39	DjOn-33-238	Flake	18
Alta 40	DjOn-34-34	Flake	18

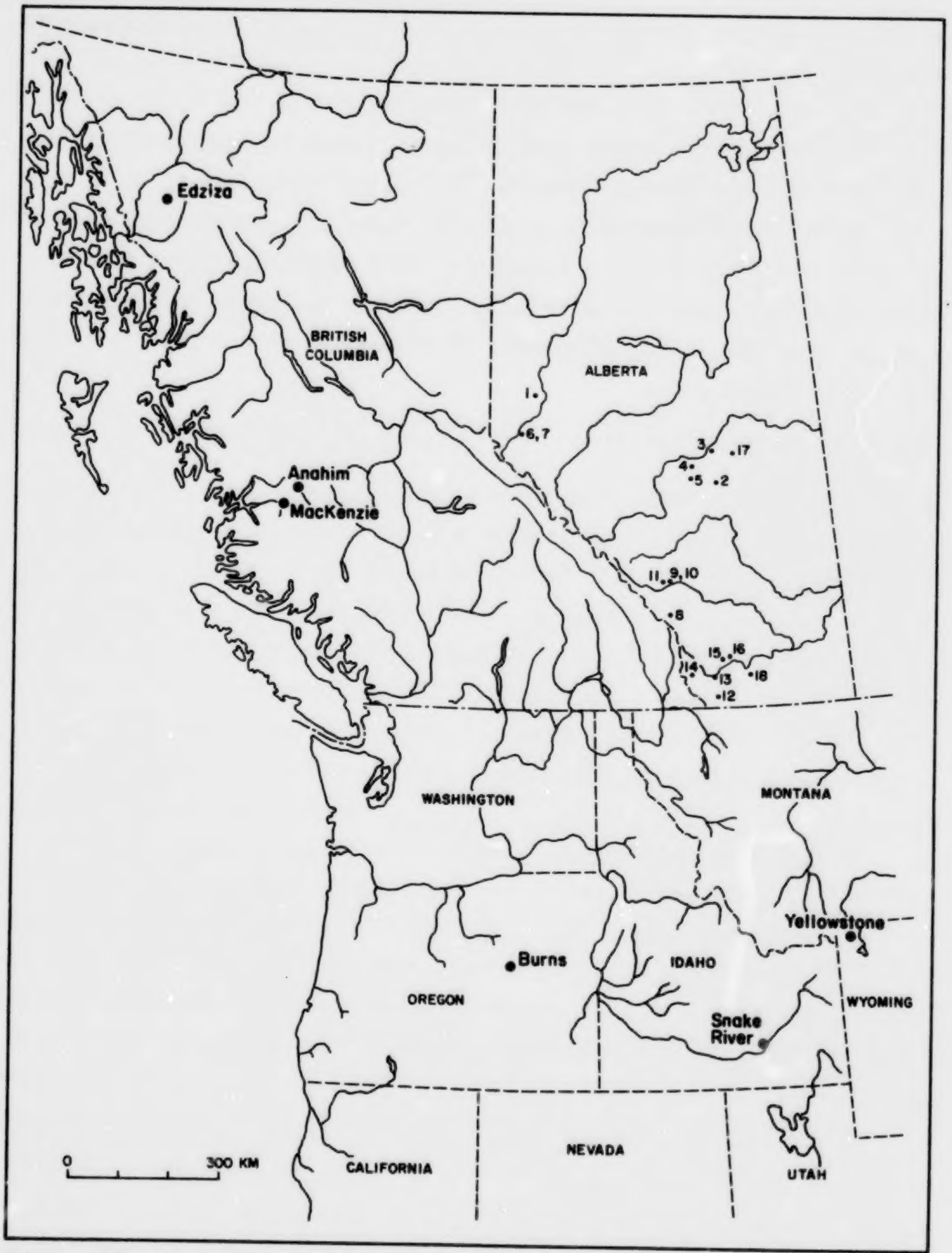

Figure 27. Location of Canadian and American obsidian sources and site locations of the artifacts Alta 1 to 40.

to being submitted for this study. This did not affect the accuracy of the XRF analysis.

REFERENCE MATERIAL: THE OBSIDIAN SOURCE COLLECTION

The reference material used in this study was the obsidian source collection at Simon Fraser University. This collection consists of obsidian rocks from a number of known obsidian sources. Obsidian sources considered in this study were those in Canada and the northwestern United States, as listed below.

Obsidian sources in Canada (except as noted, all are in British Columbia):

Mount Edziza, types 1 to 10
Felsite Creek
Mt. Hoodo, Yukon
Anahim 1 (formerly Obsidian Creek)
Anahim Pitchstone
Ilgachuz, types 1, 2 and 4
Tsitsiutl 1 and 2
MacKenzie 1 and 2
Garibaldi
Maset (a putative source)

Obsidian sources in the United States:

Yellowstone (Obsidian Cliff), Wyoming
Feather Hill, Oregon
Snake River, Idaho
Burns, Oregon
Squaw Buttes, Oregon
Hampton Station, Oregon
John Day, Oregon
Glass Buttes (three types), Oregon
Newberry Caldera (five types), Oregon
Three Sisters, Oregon
Cape Felix, Suemez Island, Alaska

In conjunction with this study, over 100 pieces of obsidian from the source collection were remeasured. This provided an updated library of source spectra and minimized the range of instrumental variation which has to be taken into account during the analyses.

UNKNOWN SOURCE SPECTRA

The "unknown" spectra are those obtained from analyses of artifacts submitted to this laboratory over the past several years whose XRF spectra do not correspond to any of the spectra obtained from the source flows listed above. In most cases, the unknown spectra were obtained from artifacts of Canadian (mostly within British Columbia and Alberta) archaeological provenance. At least seven spectroscopically distinct obsidian types of unknown origin are recognized.

THE METHOD AND THE APPARATUS

Obsidian source identification is an analytical method based on the principles that the major and trace element compositions in a volcanic glass (i.e., obsidian) are unvarying within a single flow and that small differences in the element compositions between flows lead them to be analytically distinct and therefore identifiable. Comparison of the element composition of an artifact to the element compositions of a number of obsidian source samples allows the identification of the original source of the raw material from which the artifact was manufactured in the past.

In principle, a number of analytical methods can be used to determine the elemental compositions of artifacts and source obsidian rocks. The method employed in this study was energy-dispersive X-ray fluorescence (XRF), applied semi-quantatively. The advantages of XRF are that it is nondestructive to the artifacts, easy to employ, rapid and, given due precautions, not liable to contamination. Its disadvantages are that the analyses do not yield element concentrations in weight percent or parts per million but only relative element peak ratios. In general, if an artifact can be attributed to a known source, this drawback is not significant. Using a different method, quantitative measurements can be made on a more plentiful source material at a later date.

The apparatus used for the examination was an automated X-ray fluorescence spectrometer in the Chemistry Department of Simon Fraser University. A schematic illustration of the system is shown in Figure 28.

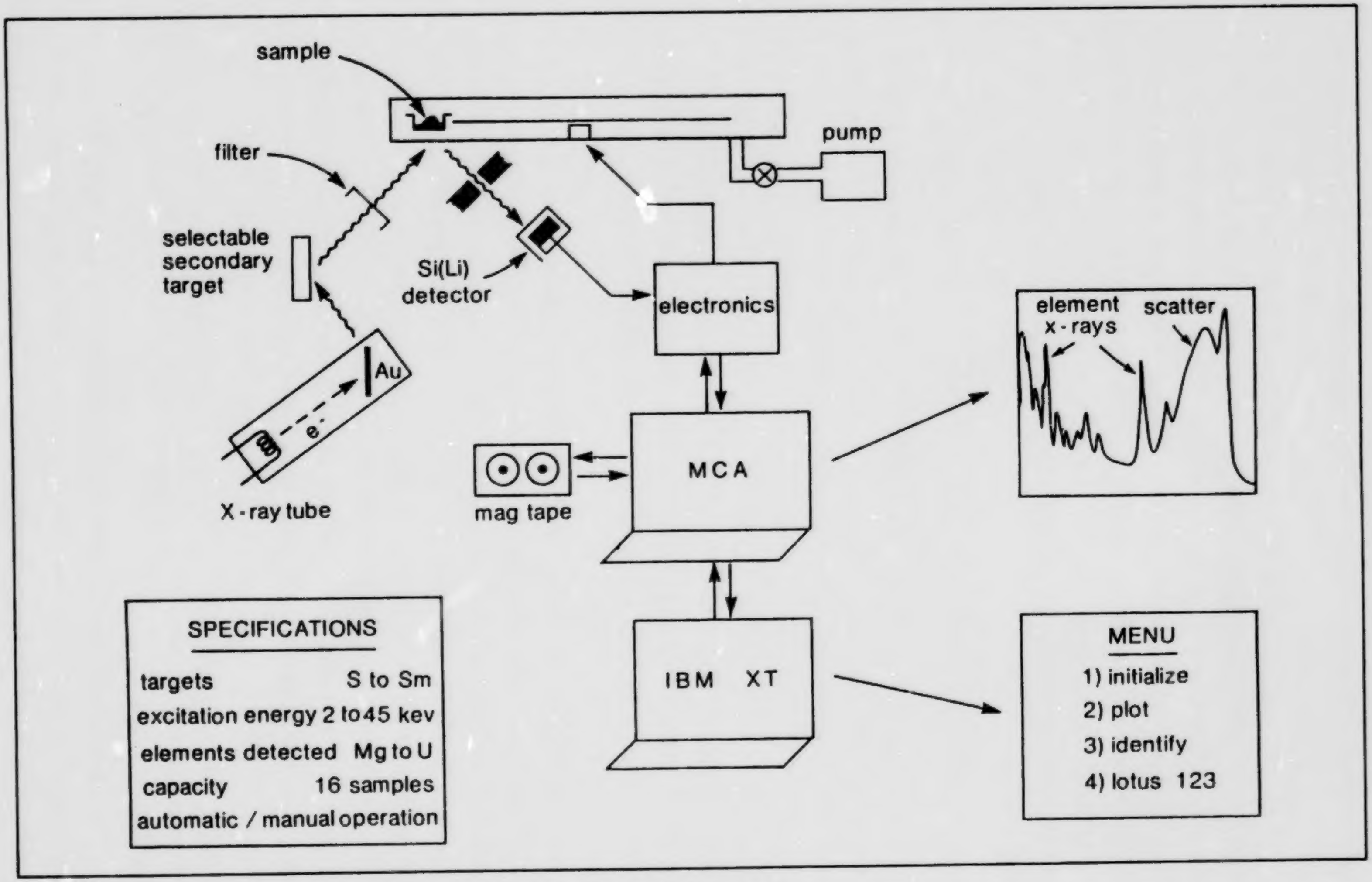

Figure 28. Schematic of the XRF apparatus used in this study.

A gold (Au) X-ray tube is used, in which high energy electrons cause the Au anode to emit highly energetic bremsstrahlung (broadband) photon radiation. This radiation causes fluorescence in a selectable secondary target. An appropriate choice of high voltage and thin-metal filter in the path of the X-ray beam from the secondary target ensures that the X-rays which cause fluorescence in the sample consist of only the characteristic K-α and K-β X-rays from the secondary target. From the seven targets in use at the XRF laboratory, a silver (Ag) target is normally chosen for obsidian analysis. X-rays characteristic of the atoms in the sample are detected with a nitrogen-cooled, solid-state silicon(lithium) (Si[Li]) detector. Pulse-processing electronics are from Kevex Corp. The system is under the control of an IBM PC-XT microcomputer. This apparatus is capable of analysing automatically up to 40 small (<2 cm), or 16 large (≤5 cm) samples.

All artifacts except as noted below, were measured using the 40-sample tray and plastic sample cups. Eleven samples (Alta 5-8, 10, 15, 20, 21, 30 and 31) were too large to fit in the small sample cups; they were measured using the 16-sample tray and 5-cm aluminum sample cups. In both cases, the artifacts rested on a thin mylar screen of the same thickness (4 μm) during tne measurement. No recalibration was necessary as a result of the change.

DATA ANALYSIS

During automated analysis, each XRF spectrum was acquired by an ND66 Pulse Height Analyzer and stored permanently on a magnetic data tape. Data pertaining to the artifacts are held on files 2-174 to 2-194, 2-198 to 2-205, 2-223 to 2-234 and 2-248. Additional files hold calibration and background spectra. The data were later downloaded from the magnetic tape to the microcomputer via the ND66 and stored on 5 1/4" floppy diskettes.

Each XRF spectrum was analysed on an IBM PC-XT microcomputer using GXL, a recently updated microcomputer version of the spectrum-stripping program GAMANAL. The GXL program performs the energy calibration, searches each data file for peaks, calculates the background and a best-fit Gaussian shape for each peak found, and compares the goodness-of-fit of the mathematical shape with the data. Examples of the calibration output and the peak area calculations for sample Alta 32 are shown in Figures 29 and 30.

Values for the Compton and Rayleigh scatter peaks (due to the scattered X-radiation from the Ag target) in each spectrum were computed using a separate program. The element peak areas and scatter peak values extracted for each spectrum were input into a Lotus 1-2-3 spreadsheet and normalized. Two methods of normalization were employed: to the K-α peak of the element zirconium (Zr) and to the Compton scatter peak.

Spectrum graphs were created with a stand-alone plotting program on a Hewlett Packard ColorPro 8-pen plotter. Element ratio scatterplots were created with the Lotus 1-2-3 program and plotted on a Roland PR-1212A dot matrix printer. Graphs of the XRF spectra of all 40 artifacts were plotted and are included in Appendix A of the full report (Godfrey-Smith 1988). A reference spectrum of Edziza 3 obsidian, on which the X-ray emission lines of the elements responsible for each peak detected are listed, is also included in Godfrey-Smith (1988).

RESULTS

Fifteen elements were detected: argon (Ar), present in the normal atmosphere, calcium (Ca), copper (Cu), gallium (Ga), iron (Fe), lead (Pb), manganese (Mn), niobium (Nb), potassium (K), rubidium (Rb), strontium (Sr), titanium (Ti), yttrium (Y), zinc (Zn) and zirconium (Zr). Of these, several were not present in sufficiently high concentrations to be detected consistently. Others elements, Zn for example, did not exhibit a sufficiently high degree of variation to be useful in intersource discrimination; therefore, numerical analyses were based on the relative values of the elements Fe, Rb, Sr, Y, Zr and Nb only. The numerical analyses yielded net element peak areas extracted by the spectrum-stripping program GXL, as well as elements normalized relative to the Compton scatter peak and elements normalized to the Zr peak (see Godfrey-Smith 1988:15-17).

On the basis of their XRF spectra, we concluded that the artifacts cluster into eight distinct spectroscopic types. The obsidian source characterizations are listed in Table 9. Twenty artifacts were

ENERGY CALIBRATION REPORT

	Old Value	New Value	
Intercept:	-.77162	-.77162	kev
Gain:	.04605	.04605	kev/ch

PEAK	Channel	Actual Energy	Calculated Energy	Deviation (kev)	Deviation (%)
Ar	81.0	2.9500	2.9585	.0085	.3
Ti	114.0	4.5100	4.4781	-.0319	-.7
Fe	156.0	6.400	6.4123	.0123	.2
Zn	205.0	8.6400	8.6687	.0287	.3
Rb	307.0	13.3940	13.3659	-.0281	-.2
Zr	359.0	15.7500	15.7605	.0105	.0

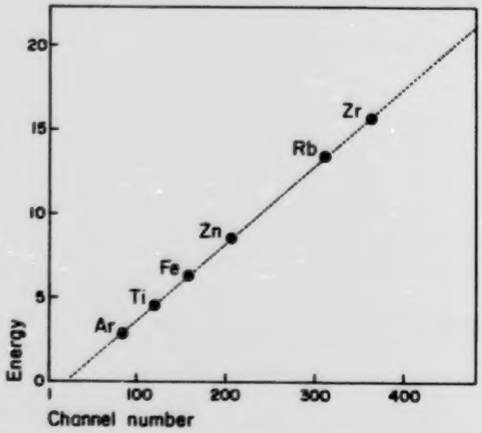

Figure 29. Energy calibration of the XRF data.

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                                  OBSIDIAN SETUP FOR 1987 ANALYSES
--------------------------------------------------------------------------------------------------------

                              - PEAK -   CALC.  NORM.                 PCT         FWJ, PCT
INDEX CHANNEL    KEV   (+/-)  START  END COUNTS COUNTS MULTIPLICITY ERROR  QFIT  USED DIFF INTENSITY
--------------------------------------------------------------------------------------------------------

   1   89.474  3.349   .004          93.5   836.   800.       2        9.48  2.1  .087 -4.7   800.2491
   2   96.495  3.672   .007   93.5  102.0   239.   228.       2       22.60  1.0   -          228.0501
   3  115.311  4.539   .009  112.0  120.0   233.   243.       2       20.67  1.5  .096  5.4   242.7436
   4  123.563  4.919   .021  120.0  127.0    70.    73.       2       56.81  1.0   -           72.9259
   5  145.190  5.914   .007  142.0  149.0   164.   156.       1       24.35  1.0  .087 -4.7   155.9678
   6  156.311  6.427   .000  148.0  163.0  9779.  9818.       1        1.84  2.7  .087 -4.7  9817.7850
   7  170.504  7.080   .001  163.0  176.0  1743.  1754.       1        3.85  1.0  .087 -4.2  1753.8930
   8  204.706  8.655   .005  198.0  211.0   308.   326.       1       17.38  1.0  .095  4.0   325.5884
   9  246.286 10.570   .006  238.0  251.0   236.   272.       1       22.34  1.0  .096  5.4   272.0387
  10  291.357 12.646   .007  287.0  295.1   249.   263.       3       20.44  1.0  .096  5.4   262.8578
  11  299.330 13.013   .007  295.1          462.   487.       3       15.73  2.7-             487.0164
  12  307.737 13.400   .002         317.0  6421.  6752.       3        4.67  8.2-            6752.4450
  13  324.129 14.155   .003  317.0  332.0   896.   980.       1       10.33  1.0  .097  5.4   979.7820
  14  341.755 14.966   .003  334.0  349.0  4542.  4969.       1        7.16  9.1  .097  5.4  4969.1090
  15  359.173 15.768   .003  351.0  367.0 14907. 16067.       1        6.93 42.5  .097  5.4 16066.9600
  16  375.683 16.529   .007  367.0         1599.  1707.       2       15.00  1.4  .097  5.4  1706.8690
  17  378.893 16.677   .004         385.0  2614.  2789.       2        9.55  1.4-            2789.0400
  18  400.618 17.677   .002  392.0  409.0  2870.  3343.       1       10.42  2.1  .097  5.4  3342.6300
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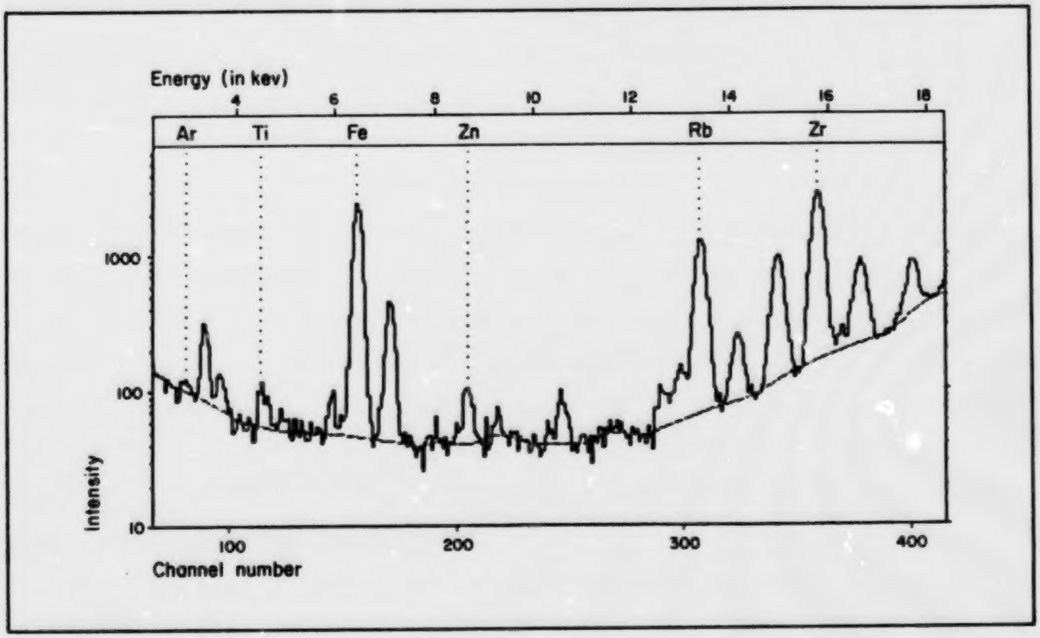

Figure 30. Sample peak extraction output.

Table 9. Source identifications of artifacts Alta 1 to 40.

ARTIFACT NO.	MAP REFERENCE	OBSIDIAN SOURCE
Alta 1	1	MacKenzie 2
2	1	Edziza 3
3	1	Edziza 3
4	1	Edziza 3
5	2	British Columbia Southern Interior A (BCSIA)
6	2	Yellowstone (Obsidian Cliff)
7	2	Yellowstone
8	2	Yellowstone
9	3	BCSIA
10	4	BCSIA
11	5	Yellowstone
12	6	Anahim 1
13	7	Edziza 3
14	8	BCSIA
15	9	BCSIA
16	9	BCSIA
17	9	BCSIA
18	10	BCSIA
19	11	Yellowstone
20	12	BCSIA
21	13	Yellowstone
22	14	Yellowstone
23	14	BCSIA
24	15	BCSIA
25	15	BCSIA
26	15	BCSIA
27	15	BCSIA
28	15	Yellowstone
29	15	BCSIA
30	15	Snake River
31	15	Burns, Area B
32	15	Snake River
33	16	BCSIA
34	16	Yellowstone
35	16	Yellowstone
36	16	BCSIA
37	17	BCSIA
38	7	Edziza 3
39	18	British Columbia Southern Interior B (BCSIB)
40	18	BCSIA

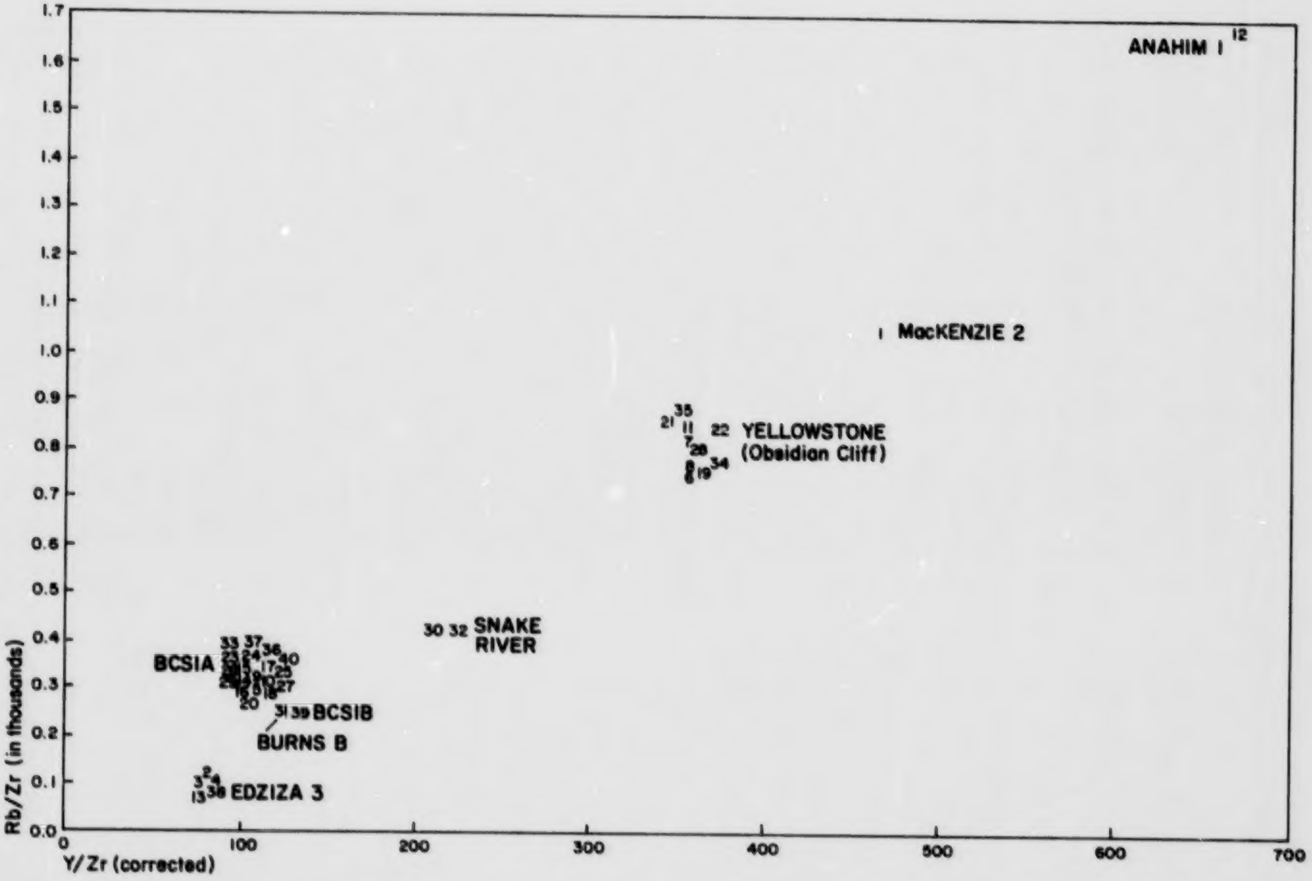

Figure 31. ASA obsidian source study, 1987 (Rb/Zr x Y/Zr).

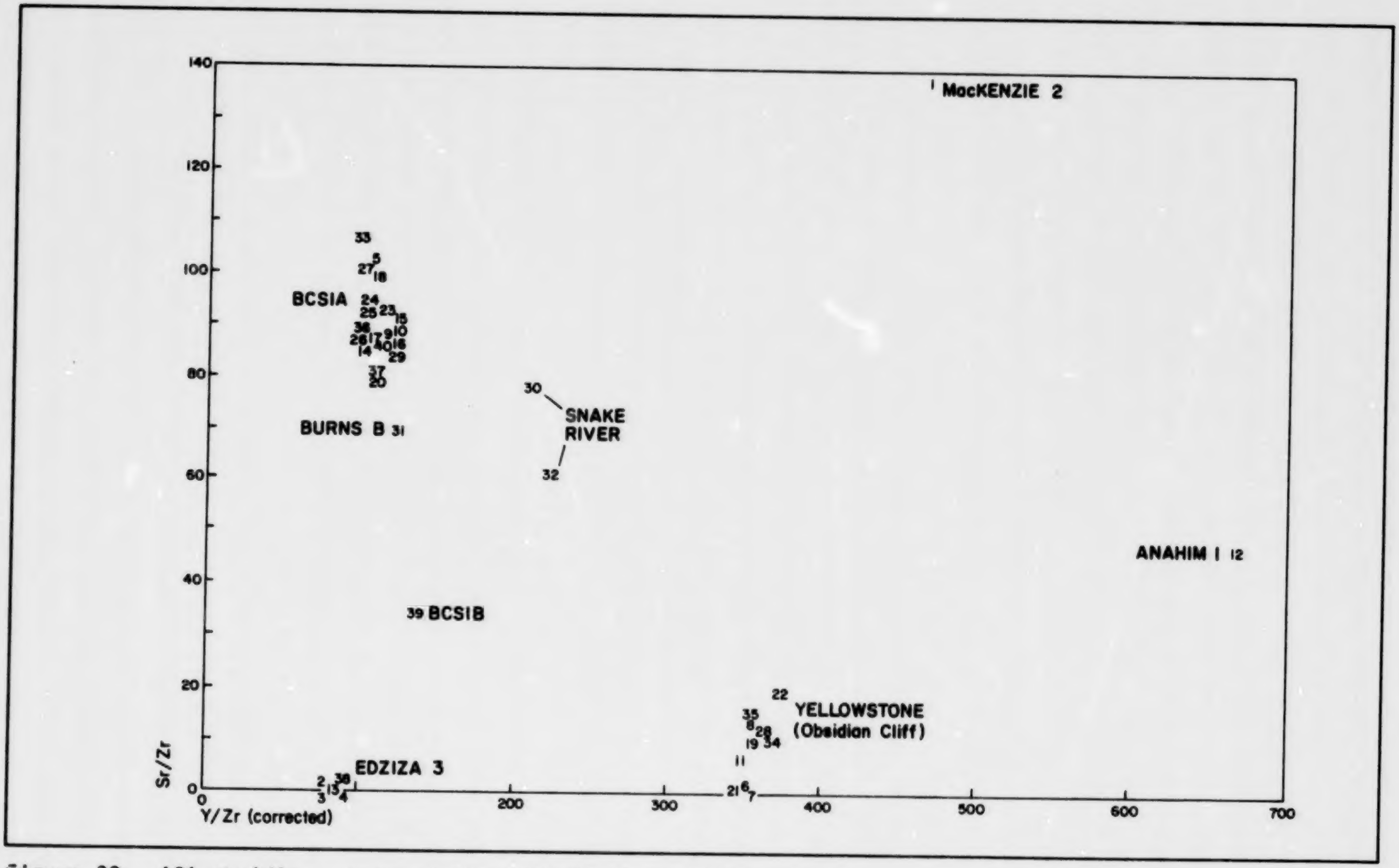

Figure 32. ASA obsidian source study, 1987 (Sr/Zr x Y/Zr).

attributed to six known obsidian sources: Anahim 1, MacKenzie 2, Mount Edziza 3, Yellowstone Obsidian Cliff, Snake River and Burns B. Nineteen artifacts were attributed to the unknown obsidian source whose spectroscopic type is known as British Columbia Southern Interior A. One artifact was attributed to obsidian of the chemical type British Columbia Southern Interior B, whose source is also unknown. The numbers and letters associated with some of the source names above refer to specific chemical variants recognized within a single source area. Obsidian flows created at different times in the history of the source volcano often have slight differences in their chemical compositions. These differences result in slightly different XRF spectra for such closely related flows.

Identifications of the obsidian sources of the artifacts were confirmed with scatterplots, in which pair-wise covariance of the relative elemental concentrations was determined. Figure 31 demonstrates the clustering of the artifacts on the basis of their relative Zr-normalized Rb and Y concentrations. Three large groupings, corresponding to Edziza 3, British Columbia Southern Interior A and Yellowstone, and one minor one, corresponding to the Snake River source, were observed. It was also observed that Alta 1 and 12 (MacKenzie 2 and Anahim 1, respectively) did not form clusters with any of the other artifacts.

The distinctiveness of Alta 31 (Burns B) and 39 (British Columbia Southern Interior B) was not apparent in the Rb vs. Y scatterplot. On the basis of their relative Zr-normalized Sr and Y concentrations (Figure 32), the separation of Alta 39 from the other clusters is clear, and the separation of Alta 31 is suggested. The distinctiveness of Alta 31 from all other artifacts is confirmed further by the Compton-normalized Rb, Zr and Y ratios of this artifact.

Full confirmation that the identification of the artifacts' sources is correct can be obtained only through quantitative, and therefore destructive, analysis. However, the XRF spectra of obsidian sources are usually as distinctive as fingerprints in people. Thus, a semi-quantitative numerical and graphical examination of an artifact's XRF "fingerprint" is sufficient to determine its source with a high degree of accuracy, in most cases. A more in-depth discussion of this aspect of semi-quantitative analysis can be found in Godfrey-Smith and D'Auria (1987).

For comparative purposes, the XRF spectra of the known obsidian sources were correlated with some of the Alta artifacts (see Godfrey-Smith 1988:Figures 7 to 12). In addition, source spectra of the obsidian from most of these sources (Yellowstone, Snake River, Anahim 1, and Edziza 3) are available in Nelson, D'Auria and Bennett (1975), Godfrey-Smith and Haywood (1984) and Godfrey-Smith and D'Auria (1984). The geographical locations of these sources are as follows:

Mt. Edziza - Northwestern British Columbia
Anahim 1 - Central British Columbia
MacKenzie 2 - Central British Columbia
Yellowstone - Yellowstone National Park, Wyoming
Snake River - Idaho
Burns - Central Oregon

The location of the Snake River obsidian source is presumed to be at Walcott, Idaho. It is also presumed that this source is the same as the obsidian source referred to in the literature as American Falls. The locations of the above sources are given in Figure 27.

The unknown obsidian sources abbreviated BCSIA and BCSIB both have been identified in a number of previous analyses of artifacts from Alberta and southwestern British Columbia. The chemical type BCSIA has been noted in obsidian as far east as Ontario, in association with obsidian from the Yellowstone source. It is thought that both represent obsidian sources in the United States. (For a more complete discussion, see Godfrey-Smith and Haywood 1984 and Godfrey-Smith and D'Auria 1984.) BCSIB is spectroscopically similar to Snake River obsidian and is likely a minor chemical variant of that source.

DISCUSSION

The distribution of the artifacts and their distance from the obsidian sources with which they have been correlated are informative as to the procurement and exchange contacts of their creators. It is not surprising to find obsidian from Anahim, MacKenzie and Edziza in the same or nearby sites, as this phenomenon has been observed on several prior occasions. Not only has Edziza obsidian been found in central and south-central British Columbia, but Anahim obsidian has been identified unambiguously in archaeological contexts in the Stikine River drainage, north of the Edziza source area.

The presence of Yellowstone obsidian and the unknown type BCSIA almost as far north as Edmonton was unexpected. A future extension of an obsidian source study to archaeological sites on the Athabasca, Wabasca, Smoky and Peace rivers would help to define the northern limits of the spread of Yellowstone obsidian into Alberta in prehistoric times.

As stated above, the association of the unknown BCSIA with Yellowstone obsidian has been observed during several earlier studies. Its increasing incidence in the south of Alberta and its association with obsidian from Oregon and Idaho sources are consistent with prior suggestions that its source is located in the United States. The BCSIA spectrum is common among obsidian artifacts, suggesting that the source was a major one. The identification of the source locality would make a significant contribution to our understanding of obsidian exchange strategies. The relative significance of the known obsidian sources within northwestern North America to distant areas, across both natural and cultural boundaries, would be clarified as well.

ACKNOWLEDGEMENTS

We are very grateful to J.M. D'Auria for his permission to use the XRF facilities in the Chemistry Department at Simon Fraser University, to D.E. Nelson for his generous permission to use some of his extensive collection of obsidian source material, and to M. Cackette, who wrote the spectrum-stripping program GXL and made it available for these analyses.

ENVIRONMENT CANADA, PARKS, ARCHAEOLOGY IN ALBERTA, 1987

By
John Porter, Kathy Dilts, Daryl Fedje,
Ian Sumpter and Rod Pickard
Archaeological Research Services Unit
Canadian Parks Service

INTRODUCTION

The Archaeological Research Services Unit of the Western Regional Office of Canadian Parks Service directed a total of 120 projects during 1987. This discussion concerns the 75 projects that relate to national parks and national historical parks and sites in Alberta. These projects include 42 archaeological resource impact assessments (ARIAs), 26 special projects, four projects involving monitoring, two programmes of combined ARIA/monitoring and one mitigative excavation (Table 10). As in previous years, a number of programmes (13) were completed under contract. A total of 152 new archaeological sites were recorded in the Alberta parks in 1987 (Table 11), and fifty known sites were reassessed. Brief summaries of the investigations and results of major projects conducted in 1987 follow. Some special projects not discussed in detail but worthy of note are outlined below.

The Archaeological Research Services Unit continued development of a computer-based informational management system. The programme includes entry of management data, the creation of a system-wide data base and the standardizing of site data and management strategies. A contract for the organization of the Banff and Jasper lithic material reference collections was initiated. Two marine archaeology projects were undertaken: in Emerald Bay, Waterton Lakes National Park, Jim Ringer (Marine Archaeology Section, Parks Headquarters) conducted an assessment of an historical refuse concentration and the old Minnewanka Landing at Lake Minnewanka in Banff National Park was recorded by Graham and Duncan MacDonald (Nautilus Diving Ventures). Finally, an ARIA at Sunshine Village was completed by Environmental Management Associates. A list of Alberta projects and researchers is given in Table 10. All projects were under the financial management of Don Steer, Head, Archaeological Research Services Unit, Western Region.

Results of all projects will appear in one or more of the following: in-house manuscripts, external publications, or one of the Canadian Parks Service three publication formats (the Microfiche Report Series [MRS], Research Bulletins or Studies in Archaeology, Architecture and History). Access to or information regarding these reports can be obtained from the Archaeological Research Services Unit, Calgary.

Archaeological Research Services Bibliography (Kathy Dilts)

A reference bibliography was recently compiled for the Archaeological Research Services Unit. References cited in this bibliography relate directly to the archaeology and history of national parks and national historical parks and sites in the western region. Some reports dealing with other disciplines have been included if their content is deemed significant to the archaeology/history of the study area.

The majority of the bibliographic entries are the product of the Archaeological Research Services Unit staff publications; however, a number of the reports cited were produced by other agencies or individuals through contract work with the Canadian Parks Service or on an independent basis. Most references are on file with either the Archaeological Research Services Unit or Historical Research Services Unit, Western Region.

The reference source, entitled "Bibliography, Archaeological Research Services, Canadian Parks Service, Western Region," was compiled by Kathy Dilts and Don Steer. It will be updated annually to provide a comprehensive, current list of archaeological and historical reports, manuscripts and monographs associated with national parks and national historic parks and sites in the western region. Copies of this bibliography can be obtained by writing to the Archaeological Research Services Unit, Canadian Parks Service, Room 552, 220 - 4th Avenue S.E., Calgary, Alberta, Canada, T2P 3H8, Attention: Head, Archaeological Research.

Banff National Park Resource Description Activities (Daryl Fedje)

The 1987 field programme in Banff National Park focussed on gathering data towards the preparation of the Banff Archaeological Resource Description for management purposes. The programme included overviews of several major valleys and mountain passes and moderately intensive reconnaissance of the Red Deer River valley.

Within the overview portion of the programme, 57 prehistoric and four historical period sites were located, and 40 previously recorded sites were reassessed. In addition to site location, new data as to lithic sources were obtained. Sources for quartzite, crystal quartzite and soapstone were located in the environs of Simpson, Healy and Redearth passes (Bow/Simpson Divide). Sources for siliceous siltstone and ironstone were located in the Divide Pass area (Red Deer/Clearwater Divide).

Reconnaissance in the Red Deer River valley included inventories and assessments of selected areas conducted under contract by Bison Historical Services Ltd. and limited assessments and test excavations by the Canadian Parks Service. Bison identified three historical and 45 prehistoric sites, including a deeply stratified site, with a record extending back to ca. 6,800 years B.P., and a pithouse site (Van Dyke 1987).

The Canadian Parks Service conducted preliminary excavations at the Divide Creek site which had been tested previously (Fedje 1987a). Excavations on one cultural depression produced diagnostic evidence for at least three periods of use, extending back to the Middle Prehistoric Period. (Radiocarbon assays are forthcoming.)

Site Assessment and Test Monitoring in Banff National Park, 1987. Trans-Canada Highway Phase III (John Porter)

As part of the 1987 field programme in Banff National Park, an ARIA was conducted along a third alternate route for twinning of the Trans-Canada Highway. No new archaeological resources were identified, but a previously recorded historical site (531R) was revisited.

Generally, the route traverses low potential landforms, and focal areas for site location are infrequent.

Assessment of ten proposed borrow sources revealed an historical cabin berm with associated depressions and refuse area (142R). Monitoring of Public Works Canada borrow source testing programme revealed no additional archaeological resources.

Western Region's Salvage Archaeology Programme - Alberta's National Parks: A Review (Ian Sumpter)

In response to a number of proposed terrain-modifying development projects, a two-person field crew under the auspices of the Canadian Parks Service, Archaeological Research Services Unit conducted a series of archaeological resource overviews, impact assessments and monitoring studies (n=45) in Banff, Elk Island, Jasper and Waterton Lakes national parks (Sumpter and Perry 1988).

In Banff National Park, a five-week programme included the completion of ten projects: eight impact assessments, one monitoring study, and a general site inventory programme (see Figures 33 to 36). The field examinations resulted in the recording of seven historical period sites and one resource containing both prehistoric and historical components.

In Elk Island National Park, a total of five ARIAs and one monitoring project were undertaken over a six-day period (see Figure 37). Investigations within the proposed project zones resulted in the relocation of three previously recorded prehistoric sites. Two of the three sites were of concern during monitoring of the proponent's trenching activity. One resource site will require further, detailed evaluations if impact is unavoidable.

During a five-week period, a total of 20 ARIA and two overview studies were conducted in Jasper National Park (see Figure 38). An overview assessment pertaining to Transmountain Pipeline's utility corridor yielded potentially significant archaeological concerns. Further detailed investigations of the proponent's route are pending.

Finally, in Waterton Lakes National Park, eight impact assessments and one monitoring project were completed over a seven-day duration (see

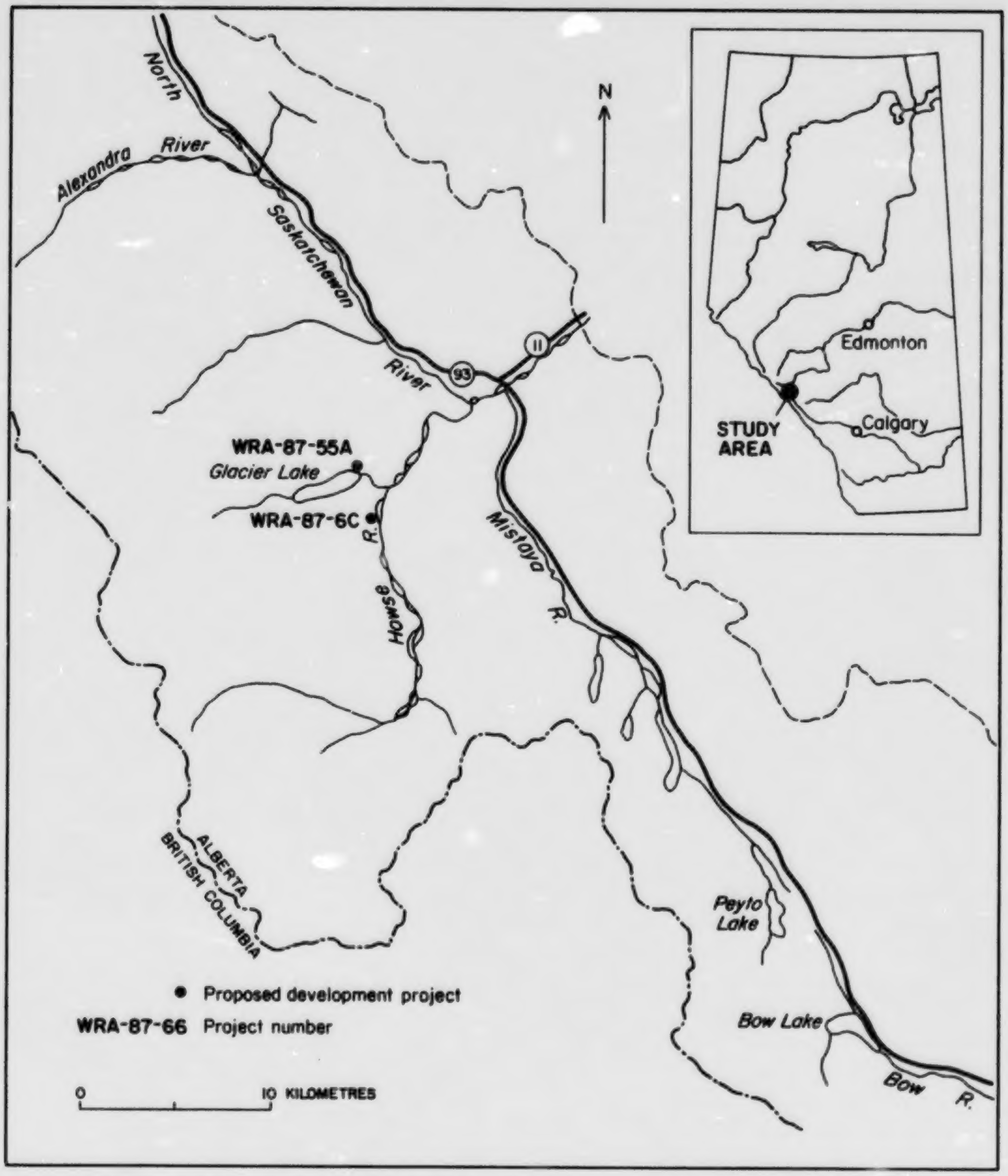

Figure 33. Locations of 1987 ARIA projects, northern Banff National Park.

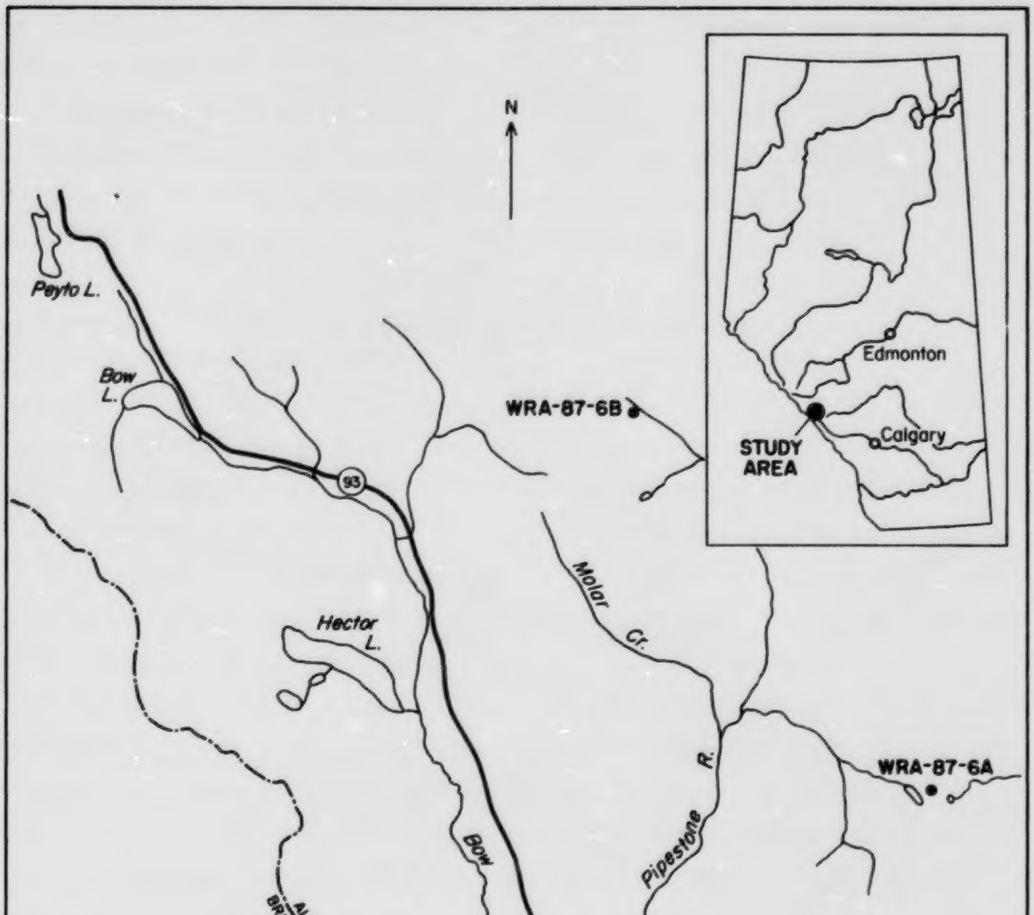

Figure 34. Locations of 1987 ARIA projects, Lake Louise area.

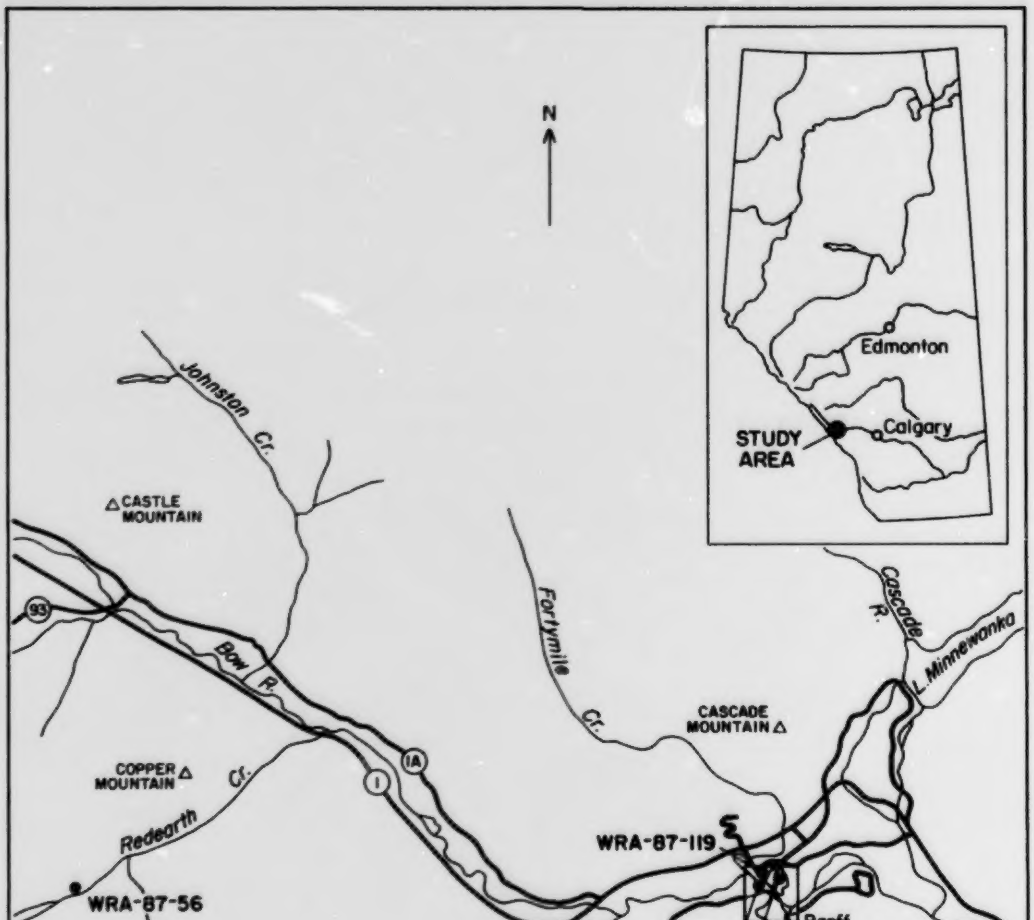

Figure 35. Locations of 1987 ARIA projects, Banff townsite area.

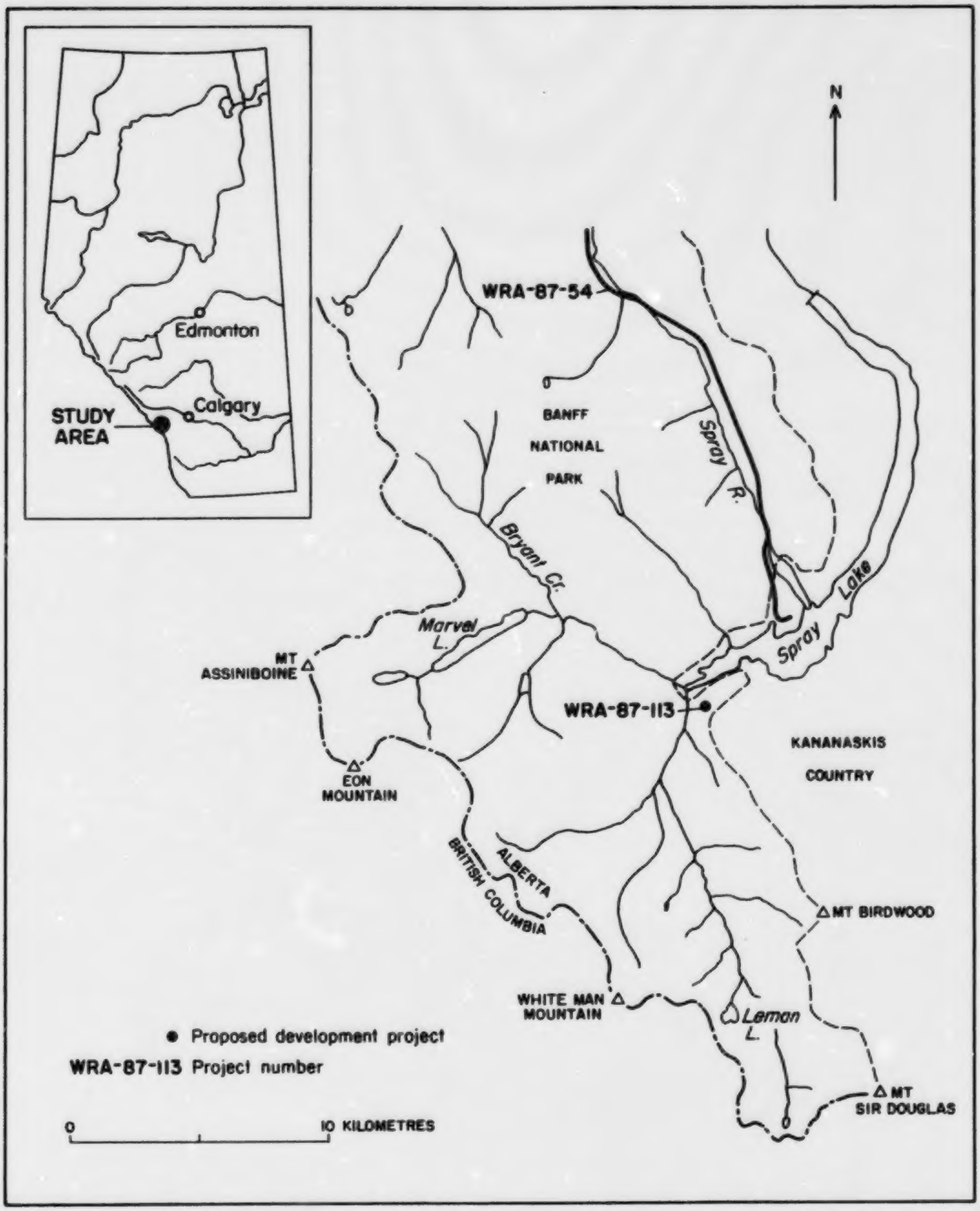

Figure 36. Locations of 1987 ARIA projects, southern Banff National Park.

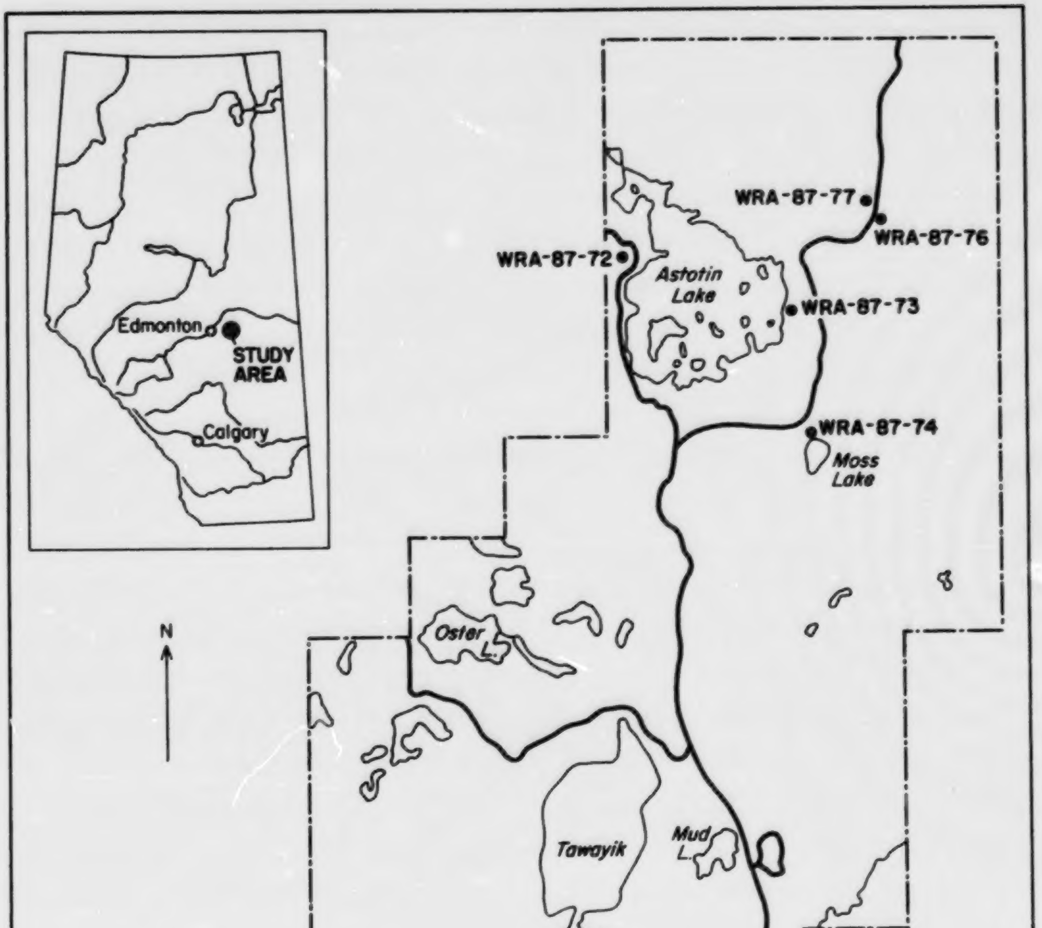

Figure 37. Locations of 1987 ARIA projects, Elk Island National Park.

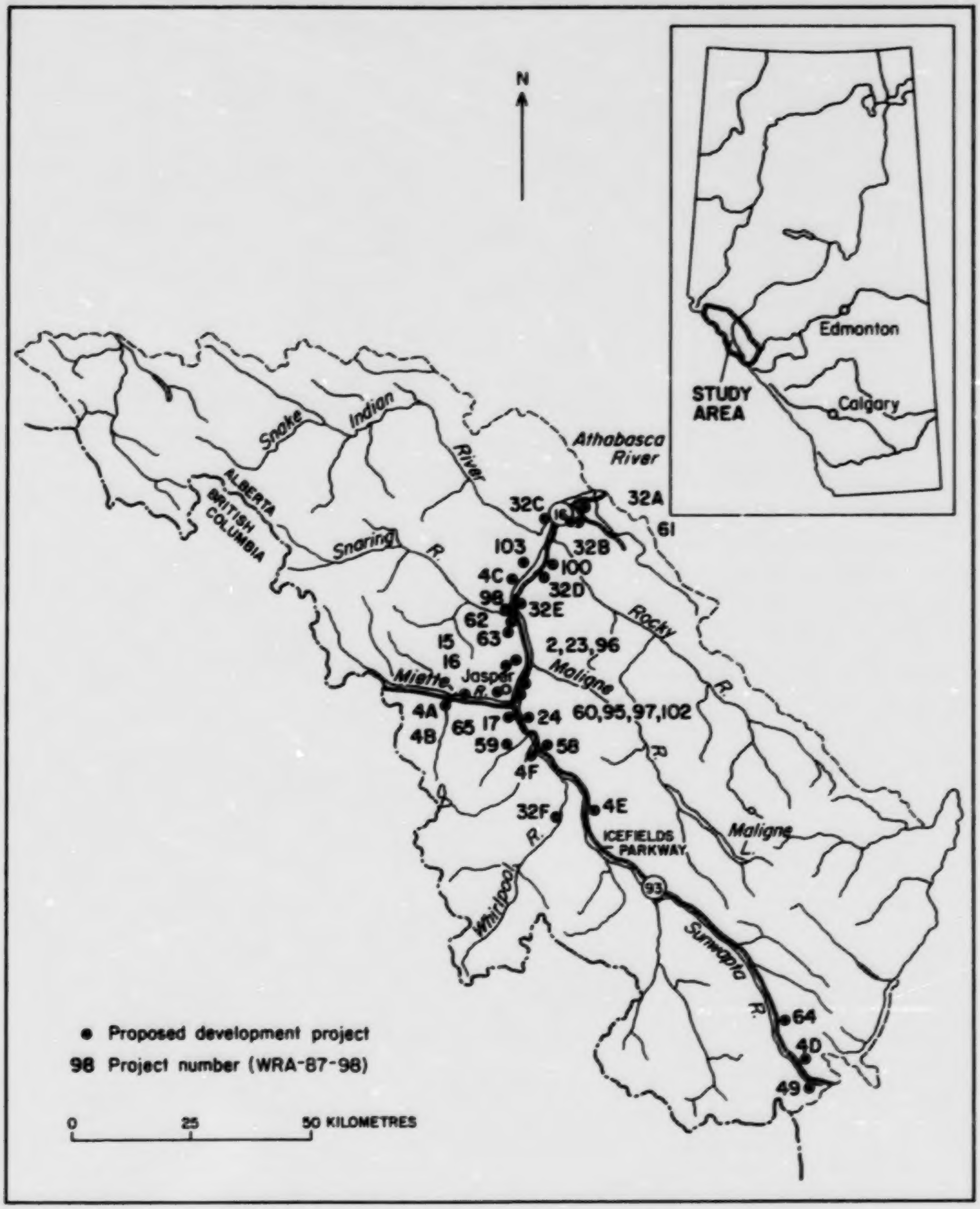

Figure 38. Locations of 1987 ARIA projects and survey projects, Jasper National Park.

Figure 39). Five of the eight development projects raised heritage concerns, resulting from the evaluative testing of four known prehistoric sites and the discovery of one palaeontological resource. Of note in the park are the results of mitigative excavations in the vicinity of site 646R (DgPl-18) at Lake Linnet. In contrast to the 1986 exploratory excavation results (Steer et al. 1987; Sumpter 1987), mitigation yielded a low number of cultural items. Initial investigations by Reeves (1969a) revealed the presence of early prehistoric cultural complexes he defined as Lake Linnet I and II (Reeves 1971, 1975).

Jasper National Park Field Programme (Rod Pickard)

Archaeological field and computer-based studies were conducted in conjunction with the planned preparation of an Archaeological Resource Description (ARD) for Jasper National Park. The research framework for the fieldwork component was developed by the Archaeological Research Services Unit with the specific aim of initiating studies which would aid in the development of a provisional cultural chronology for the Jasper National Park region. The general plan was to conduct limited, highly focussed excavations at what were deemed to be significant sites, based on the recommendations of previous researchers. The amount of excavation at each site was scaled according to the availability of funds. The field component was contracted to Bison Historical Services Ltd. of Calgary under the project direction of Tom Head. Rod Pickard of the Western Regional Office worked closely with the contractor.

In two weeks, a three-person crew tested seven prehistoric sites. Significant archaeological results were recovered from Devona Cave (239R), Mountain Creek (1073R) and site 1304R. A radiocarbon date of 4,242 ± 90 years B.P. was obtained on charcoal found in association with an Oxbow-style projectile point and obsidian from Devona Cave (Head 1987:VII). Four projectile points and assorted debitage were found at the Mountain Creek site (Head 1987). Radiocarbon dates of 3,350 ± 130 years B.P. and 6,620 ± 120 years B.P. were obtained on charcoal found in close vertical association with the cultural horizon (Wilson 1987). Tentative interpretation of dates and diagnostic cultural material suggests that the site contains a McKean occupation, evidenced by a

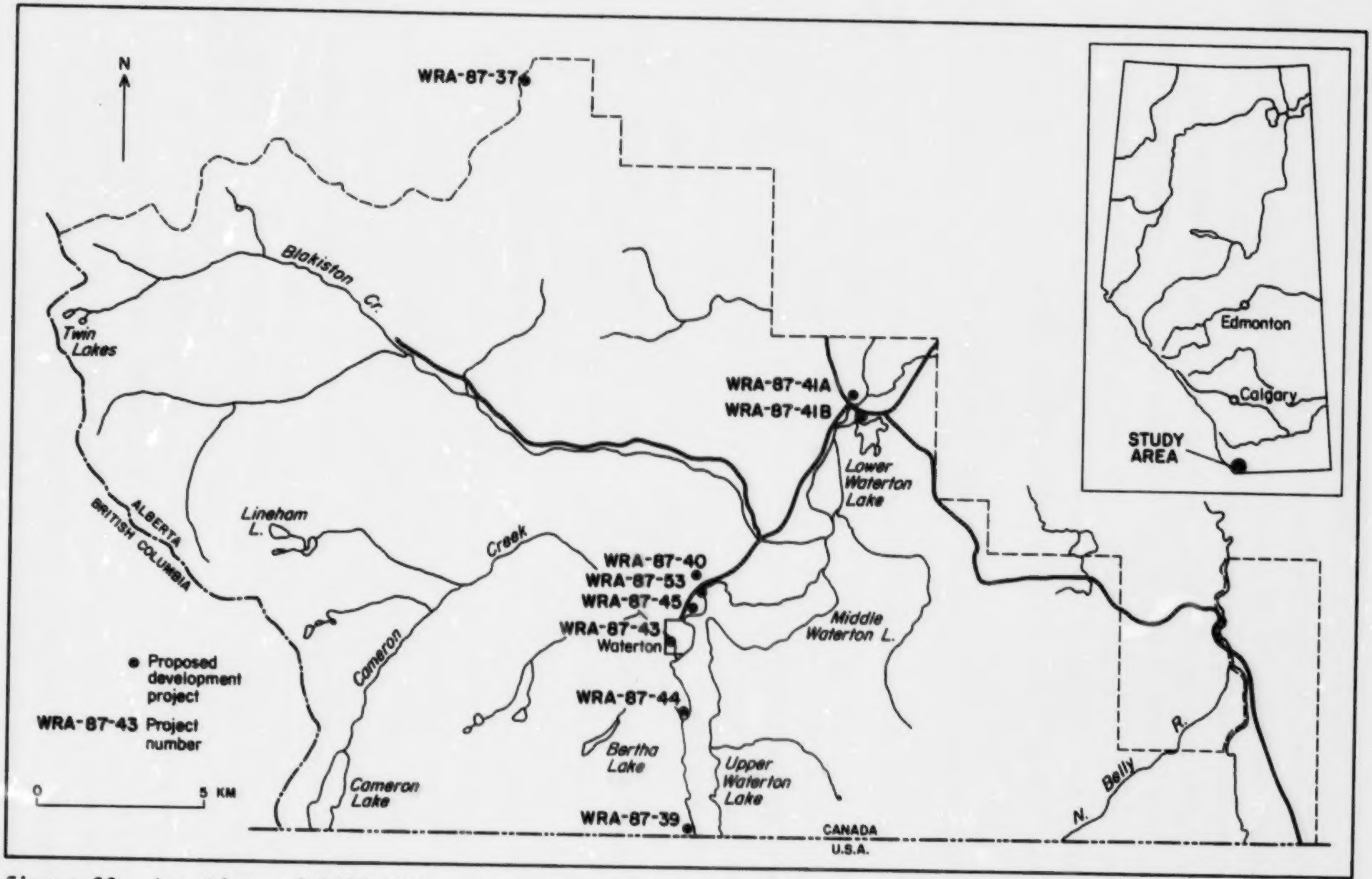

Figure 39. Locations of 1987 ARIA projects, Waterton Lakes National Park.

McKean-style point associated with the 3,350 years B.P. date and side-notched points (possibly Mummy Cave) associated with the 6,620 years B.P. date (Head 1987). Site 1340R contained debitage in a pre-St. Helens Yn stratigraphic context. Samples from a sealed, deeply buried, obsidian-bearing horizon have been submitted for accelerated dating.

The analysis component of the project consisted of the capturing and coding of relevant site management data for the some 400 archaeological resources. Data entry and manipulation were contracted to the Computer Services Department of the University of Calgary. At present, work is ongoing on the production of the final ARD, based on the findings of previous studies and the results of the current year's work.

Table 10. Projects conducted/implemented in Alberta by the Archaeological Research Services Unit, Canadian Parks Service, Western Region.

Project Number	Researcher	Project Description
WRA-87-2	Ian Sumpter	ARIA - Underground cable installation, Lakes Edith/Annette, Jasper National Park
WRA-87-4	Ian Sumpter	ARIA - Streambed manipulation, Jasper National Park
WRA-87-6	Bill Perry	ARIA - Warden cabin assessments, Banff National Park
WRA-87-8	Ian Sumpter	ARIA - Rimrock Inn historical dump revisitation, Banff National Park
WRA-87-10	Jack Porter	ARIA/Monitoring - Trans-Canada Highway twinning phase III, Banff National Park
WRA-87-11	Jim Ringer	Special Project - Emerald Bay marine archaeology, Waterton Lakes National Park
WRA-87-12	Daryl Fedje Kevin Montgomery Don Steer	Special Project - Archaeological resource description/manual preparation, Banff National Park
WRA-87-13	Don Steer	Special Project - Proposed reconstruction of site 15R, Rocky Mountain House National Historic Park
WRA-87-15	Ian Sumpter	ARIA - Pyramid Lake Bungalows expansion, Jasper National Park
WRA-87-16	Ian Sumpter	ARIA - Pyramid Lake beach road grade, Jasper National Park
WRA-87-17	Ian Sumpter	ARIA - Whistler campground power cable replacement, Jasper National Park
WRA-87-18	Rod Pickard Kevin Montgomery Don Steer	Special Project - Archaeological resource description/manual preparation, Jasper National Park
WRA-87-20	Bison Historical Services Ltd.	Special Project - Archaeological resources survey and assessment, upper Red Deer River valley (contract), Banff National Park

Table 10. continued

Project Number	Researcher	Project Description
WRA-87-23	Bill Perry	ARIA - A.G.T. underground cable installation, Lake Edith, Jasper National Park
WRA-87-24	Ian Sumpter	ARIA - Jasper House Bungalows electrical line installation, Jasper National Park
WRA-87-28	Don Steer	Special Project - 1987 Archaeological Research Services Unit volunteer programme, Western Regional Office
WRA-87-31	Harold Hussey	Special Project - Specialty services/products for archaeology (contract), Western Regional Office
WRA-87-32	Bison Historical Services Ltd.	Special Project - Archaeological resources assessments and mitigation (contract), Jasper National Park
WRA-87-33	Ben Hjermstad	Special Project - Collections reorganization (contract), Western Regional Office
WRA-87-34	Rick Lalonde	Special Project - 1987 archaeological resource map preparation and drafting support (contract), Western Regional Office
WRA-87-35	Ian Sumpter	ARIA - Canadian Pacific Railway underpass, Lake Louise, Banff National Park
WRA-87-36	Ian Sumpter	ARIA - Lake Louise pedestrian trails, Banff National Park
WRA-87-37	Ian Sumpter	ARIA - Shell pipeline installation, Yarrow Creek, Waterton Lakes National Park
WRA-87-39	Ian Sumpter	ARIA - Primitive campsite improvements, Boundary Bay Campsite, Waterton Lakes National Park
WRA-87-40	Ian Sumpter	ARIA - Maintenance compound expansion, Waterton Lakes National Park
WRA-87-41	Ian Sumpter	ARIA - Information centre development, Waterton Lakes National Park

Table 10. continued

Project Number	Researcher	Project Description
WRA-87-42	Bill Perry	Monitoring - Water main installation, administration building, Banff National Park
WRA-87-43	Ian Sumpter	Monitoring - Waterton townsite water supply, Waterton Lakes National Park
WRA-87-44	Ian Sumpter	ARIA - Lakeshore trail improvements, Waterton Lakes National Park
WRA-87-45	Ian Sumpter	ARIA - Prince of Wales Hotel toxic spill clean-up, Waterton Lakes National Park
WRA-87-46	University of Calgary	Special Project - Computer tabulation and graphics, archaeological resource description (contract), Jasper National Park
WRA-87-49	Rod Pickard	Special Project - Columbia Icefields redevelopment - overview, Jasper National Park
WRA-87-53	Bill Perry	Mitigation - Linnet Lake boat launch improvements, Waterton Lakes National Park
WRA-87-54	Ian Sumpter	ARIA - Spray River fire road rehabilitation, Banff National Park
WRA-87-55	Ian Sumpter	ARIA - Primitive campsite development, Banff National Park
WRA-87-56	Ian Sumpter	ARIA - Brewster cabin development, Banff National Park
WRA-87-57	Bill Perry	Monitoring - Mountview Village development, Banff National Park
WRA-87-58	Bill Perry	ARIA - Beckers Bungalows buried cable installation, Jasper National Park
WRA-87-59	Ian Sumpter	ARIA - Marmot Basin sewage lagoon, Jasper National Park
WRA-87-60	Ian Sumpter	Special Project - Townsite water supply overview, Jasper National Park

Table 10. continued

Project Number	Researcher	Project Description
WRA-87-61	Ian Sumpter	ARIA - Punchbowl Falls pull-off and trail development, Jasper National Park
WRA-87-62	Ian Sumpter	ARIA - Fire management programme, Jasper National Park
WRA-87-63	Ian Sumpter	ARIA - Site 979R revisitation, Jasper National Park
WRA-87-64	Ian Sumpter	ARIA - Tangle Falls visitor access, Jasper National Park
WRA-87-65	Ian Sumpter	ARIA - Water well installation, Jasper National Park
WRA-87-71	Rod Pickard	Special Project - Transmountain pipeline overview, Jasper National Park
WRA-87-72	Bill Perry	ARIA - Sewage lagoon modifications, Elk Island National Park
WRA-87-73	Bill Perry	ARIA/Monitoring - Astotin Lake D.U.A. powerline installation, Elk Island National Park
WRA-87-74	Bill Perry	ARIA - Moss Lake picnic area redevelopment, Elk Island National Park
WRA-87-75	Bill Perry	ARIA - Boundary Road bridge replacement, Elk Island National Park
WRA-87-76	Bill Perry	ARIA - Beaver Pond trailhead improvements, Elk Island National Park
WRA-87-77	Bill Perry	ARIA - White Spruce trail improvements, Elk Island National Park
WRA-87-91	Environment Management Associates	ARIA - Sunshine Village archaeological studies (contract), Banff National Park
WRA-87-93	Ben Hjermstad	Special Project - Collections management general support (contract), Western Regional Office

Table 10. continued

Project Number	Researcher	Project Description
WRA-87-94	Graham MacDonald Duncan MacDonald	Special Project - Underwater archaeology, site recording, Old Minnewanka Landing, Banff National Park
WRA-87-95	Bill Perry	ARIA - Cottonwood Creek trailer park rehabilitation, Jasper National Park
WRA-87-96	Bill Perry	ARIA - Lake Edith sewage system installation, Jasper National Park
WRA-87-97	Bill Perry	ARIA - Compound access road clean-up and Tekarra Lodge water service line, Jasper National Park
WRA-87-98	Bill Perry	ARIA - Snaring overflow campground development, Jasper National Park
WRA-87-100	Bill Perry	ARIA - Talbot Lake Picnic Area expansion, Jasper National Park
WRA-87-102	Bill Perry	ARIA - Block "S" industrial development, Jasper National Park
WRA-87-103	Bill Perry	ARIA - Celestine Lake road improvement, Windy Point, Jasper National Park
WRA-87-104	Daryl Fedje Ian Sumpter Bill Perry	Special Project - General resource site inventory, Western Regional Office
WRA-87-106	Brock University	Special Project - 1987 western region radiocarbon dating (contract), Western Regional Office
WRA-87-107	Don Steer	Special Project - western region archaeology multi-year operational planning review and preparation, Western Regional Office
WRA-87-108	Ben Hjermstad	Special Project - Computer coding, archaeological resource information (contract), Western Regional Office
WRA-87-112	Bison Historical Services Ltd.	ARIA - Banff Springs Golf Course buried utility line (contract), Banff National Park

Table 10. continued

Project Number	Researcher	Project Description
WRA-87-113	Bill Perry	ARIA - Watridge Lake trail redevelopment, Banff National Park
WRA-87-114	Heather D'Amour	Special Project - Regional collections management programme, Western Regional Office
WRA-87-115	Kevin Montgomery	Special Project - Archaeological site data compilation, Western Regional Office
WRA-87-116	University of Western Ontario	Special Project - Tephra identification (contract), Western Regional Office
WRA-87-117	Jack Porter Kathy Dilts	Special Project - A.S.A. occasional paper submission, Environment Canada, Canadian Parks Service, Archaeological Research Services Unit, Western Regional Office
WRA-87-118	Don Steer	Special Project - Society of Historical Archaeology Newsletter current research submission, Western Regional Office
WRA-87-119	Bill Perry	Monitoring - C.P.R. sewer, waterline and road installation, Banff National Park
WRA-87-120	Beth Monod	Special Project - Artifact illustration (contract), Western Regional Office

Table 11. Summary of newly recorded archaeological sites in western region national parks 1987.

Project Number	Park Site Number	Site Type
Banff National Park		
WRA-87-6	1216R	Historical warden's cabin
WRA-87-6	1217R	Historical warden's cabin
WRA-87-36	1221R	Historical trail
WRA-87-54	1222R	Historical bridge remains
WRA-87-54	1223R	Historical structural remains
WRA-87-55	1224R	Historical cabin/prehistoric site
WRA-87-12	1225R	Historical cabin
WRA-87-104	1240R	Prehistoric site
WRA-87-12	1241R	Prehistoric site
WRA-87-12	1242R	Prehistoric site
WRA-87-12	1243R	Prehistoric site
WRA-87-12	1244R	Prehistoric site
WRA-87-12	1245R	Prehistoric site
WRA-87-12	1246R	Prehistoric site
WRA-87-12	1247R	Prehistoric site
WRA-87-12	1248R	Prehistoric site
WRA-87-12	1249R	Prehistoric site
WRA-87-12	1250R	Prehistoric site
WRA-87-12	1251R	Prehistoric site
WRA-87-12	1252R	Prehistoric site
WRA-87-12	1253R	Prehistoric site
WRA-87-12	1254R	Prehistoric site
WRA-87-12	1255R	Prehistoric site
WRA-87-12	1272R	Prehistoric site
WRA-87-12	1273R	Prehistoric site
WRA-87-12	1275R	Prehistoric site
WRA-87-12	1276R	Prehistoric site
WRA-87-12	1277R	Prehistoric site
WRA-87-12	1278R	Prehistoric site
WRA-87-12	1279R	Prehistoric site
WRA-87-12	1280R	Prehistoric site
WRA-87-12	1281R	Prehistoric site
WRA-87-12	1282R	Prehistoric site
WRA-87-12	1283R	Prehistoric site
WRA-87-12	1285R	Prehistoric site
WRA-87-12	1286R	Undetermined site
WRA-87-12	1287R	Prehistoric site
WRA-87-12	1289R	Prehistoric site
WRA-87-12	1290R	Prehistoric site
WRA-87-12	1291R	Prehistoric site
WRA-87-12	1292R	Prehistoric site
WRA-87-12	1293R	Prehistoric site
WRA-87-12	1294R	Historical site

Table 11. continued

Project Number	Park Site Number	Site Type
Banff National Park continued		
WRA-87-12	1295R	Prehistoric site
WRA-87-12	1297R	Prehistoric site
WRA-87-12	1298R	Prehistoric site
WRA-87-12	1299R	Prehistoric site
WRA-87-12	1300R	Prehistoric site
WRA-87-104	1330R	Historical cabin
WRA-87-56	1331R	Historical cabin
WRA-87-54	1332R	Historical cabins
WRA-87-20	1341R	Prehistoric site
WRA-87-20	1342R	Prehistoric site
WRA-87-20	1343R	Prehistoric site
WRA-87-20	1344R	Prehistoric site
WRA-87-20	1345R	Prehistoric site
WRA-87-20	1346R	Prehistoric site
WRA-87-20	1347R	Prehistoric site
WRA-87-20	1348R	Prehistoric site
WRA-87-20	1349R	Prehistoric site
WRA-87-20	1350R	Prehistoric site
WRA-87-20	1351R	Prehistoric site
WRA-87-20	1352R	Prehistoric site
WRA-87-20	1353R	Prehistoric site
WRA-87-20	1354R	Prehistoric site
WRA-87-20	1355R	Prehistoric site
WRA-87-20	1356R	Prehistoric site
WRA-87-20	1357R	Prehistoric site
WRA-87-20	1358R	Prehistoric site
WRA-87-20	1359R	Prehistoric site
WRA-87-20	1360R	Prehistoric site
WRA-87-20	1361R	Prehistoric site
WRA-87-20	1362R	Prehistoric site
WRA-87-20	1363R	Prehistoric site
WRA-87-20	1364R	Prehistoric site
WRA-87-20	1365R	Prehistoric site
WRA-87-20	1366R	Prehistoric site
WRA-87-20	1367R	Prehistoric pit houses
WRA-87-20	1368R	Prehistoric site
WRA-87-20	1369R	Prehistoric site
WRA-87-20	1370R	Prehistoric site
WRA-87-20	1390R	Prehistoric site
WRA-87-20	1391R	Prehistoric site
WRA-87-20	1392R	Prehistoric site
WRA-87-20	1393R	Prehistoric site
WRA-87-20	1394R	Prehistoric site
WRA-87-20	1395R	Prehistoric site

Table 11. continued

Project Number	Park Site Number	Site Type
Banff National Park continued		
WRA-87-20	1396R	Prehistoric site
WRA-87-20	1397R	Prehistoric site
WRA-87-20	1398R	Prehistoric site
WRA-87-20	1399R	Prehistoric site
WRA-87-20	1400R	Prehistoric site
WRA-87-20	1401R	Prehistoric site
WRA-87-20	1402R	Historical log cabin
WRA-87-20	1403R	Historical grave
WRA-87-20	1404R	Prehistoric site
WRA-87-20	1405R	Prehistoric site
WRA-87-20	1406R	Prehistoric site
WRA-87-20	1407R	Historical site
WRA-87-91	1410R	Historical site
WRA-87-91	1411R	Historical site
WRA-87-91	1412R	Historical site
WRA-87-91	1413R	Historical site
WRA-87-12	1417R	Prehistoric site
WRA-87-12	1418R	Prehistoric site
WRA-87-12	1419R	Prehistoric site
WRA-87-12	1420R	Prehistoric site
WRA-87-12	1421R	Prehistoric site
WRA-87-10	1424R	Historical site
WRA-87-12	1425R	Prehistoric site
WRA-87-12	1426R	Historical cabin
WRA-87-12	1427R	Historical site
WRA-87-12	1428R	Prehistoric site
WRA-87-12	1429R	Prehistoric site
WRA-87-12	1430R	Prehistoric site
WRA-87-12	1431R	Prehistoric site
WRA-87-12	1432R	Prehistoric site
WRA-87-12	1433R	Prehistoric site
WRA-87-12	1434R	Prehistoric site
WRA-87-12	1435R	Prehistoric site
WRA-87-12	1436R	Prehistoric site
WRA-87-12	1437R	Prehistoric site
WRA-87-12	1438R	Prehistoric site
WRA-87-12	1439R	Prehistoric site
WRA-87-12	1440R	Prehistoric site
Jasper National Park		
WRA-87-4	1219R	Historical log cribbing
WRA-87-16	1220R	Prehistoric site
WRA-87-104	1240R	Prehistoric site

Table 11. continued

Project Number	Park Site Number	Site Type
Jasper National Park continued		
WRA-87-32	1340R	Prehistoric site
WRA-87-71	1371R	Historical depression
WRA-87-71	1372R	Historical refuse scatter
WRA-87-71	1373R	Historical drive fence
WRA-87-71	1374R	Historical cairns
WRA-87-71	1375R	Prehistoric site
WRA-87-71	1376R	Prehistoric site
WRA-87-71	1377R	Prehistoric site
WRA-87-71	1378R	Prehistoric site
WRA-87-71	1379R	Prehistoric site
WRA-87-71	1380R	Prehistoric site
WRA-87-71	1381R	Prehistoric site
WRA-87-71	1382R	Prehistoric site
WRA-87-71	1383R	Prehistoric site
WRA-87-71	1384R	Prehistoric site
WRA-87-71	1385R	Prehistoric site
WRA-87-71	1386R	Prehistoric site
WRA-87-71	1387R	Prehistoric site
WRA-87-71	1388R	Prehistoric site
WRA-87-71	1389R	Prehistoric site
WRA-87-98	1414R	Historical pilings
WRA-87-100	1415R	Prehistoric site
WRA-87-104	1416R	Palaeontological find
Waterton Lakes National Park		
WRA-87-43	1422R	Palaeontological find

Total number of archaeological sites recorded in 1987: 152

ALBERTA RADIOCARBON DATES 1986-1987

By

Alwynne B. Beaudoin

Archaeological Survey of Alberta

INTRODUCTION

This paper contains a list of all radiocarbon dates produced for the Archaeological Survey of Alberta between 1986 and 1987, subsequent to the previous listing in Beaudoin (1987). The format and style for this compilation is similar to that in Beaudoin (1987), with the exceptions that permit numbers, if applicable, are included in the references for each date, and αC-13 values, if available, comprise a separate data category. A shortened form of the abbreviations table is included here (Table 12).

The information for the dates is mainly derived from material on file at the Palynology Laboratory at the Archaeological Survey of Alberta. In 1987, the Radiocarbon and Tritium Laboratory at the Alberta Environmental Centre, Vegreville, began producing dates which were C-13 corrected. Most of the dates presented in Table 13 include this correction.

CAVEAT

This list is intended purely as an information resource for archaeologists and other researchers working in Alberta. Many of the dates are associated with on-going projects. Anyone interested in a specific date is advised to go directly to the primary source for more detail or consult the researcher(s) involved in the project.

ACKNOWLEDGEMENTS

I would like to thank my colleagues at the Archaeological Survey of Alberta for their assistance in compiling and annotating this list and Dr. L.D. Arnold (Head, Environmental Isotopes, AEC Vegreville) for discussion on radiocarbon dates and comments on a previous version of this list.

Table 12. Explanation of abbreviations and conventions used in Table 13[1].

Site #	Borden designation for the sampled site. Sites associated with palaeoenvironmental studies are indicated by "PALAEO"
Site name	If the site is named, it is included here.
ASA #	File number assigned when sample submitted through the palynology laboratory
Latitude and Longitude	Approximate values reported to the nearest minute. Values of 30" are rounded down to the nearest minute.
Level	Vertical provenience of the dated material
Depth	Given as cm or m beneath the surface unless otherwise noted. For sub-samples from lake cores associated with palaeoenvironmental studies, the depth is usually measured from the sediment/water interface.
Association	Cultural association or projectile point type associated with the dated material, as follows: AG - Agate Basin AV - Avonlea BE - Besant BH - Boss Hill BR - Bitterroot DU - Duncan HA - Hanna KP - Kootenay Plains MC - Mummy Cave MK - McKean OW - Old Women's OX - Oxbow PA - Pre-Archaic PAL - Palaeoenvironmental study PI - Palaeo-Indian PL - Pelican Lake SR - Salmon River
Material	The kind of material dated and its condition, as follows: A - Acid treatment AP - Apatite B - Burned BO - Bone C - Charred CH - Charcoal CO - Collagen CS - Core segment HA - Humic acid L - Calcined MA - Marl MC - Plant remains MX - Matrix OR - Organic material PE - Peat SED - Sediment SH - Shell WO - Wood
AECV #	The sample number assigned by the radiocarbon laboratory
C-14	Uncorrected date expressed in radiocarbon years B.P. (i.e., years before A.D. 1950). Dates flagged by "*" are C-13 corrected relative to A.D. 1950. Dates <100 years B.P. are reported as "Modern."

Table 12. continued

SD	Tne standard deviation of the radiocarbon date
αC-13	If the date is αC-13 corrected, the αC-13 value is included here. The value is in permil (‰) relative to a standard (PeeDee Belemnite or PDB). The correction applied to AECV dates in years is 16(αC-13+25).
References	Tne report(s) or publication(s) that cite the date. If part of an ongoing study, the name(s) of the principal researcher(s) are given. The project permit number, if applicable, is also included.
Comments	Any special notes are given here. The following codes may be used: AMS - Accelerator date BIT - Bitumen removed P - Pit feature UN - Unreliable, usually due to contamination

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[1] Blank entries in any category indicate that no information is available.

Table 13. Radiocarbon dates from Alberta.

Site #	Site Name	ASA #	Latitude	Longitude	Level	Depth	Association	Material	AECV #	C-14 date	SD	αC-13 permil (‰)	References & Permit nos.	Comments
-	-	D87-4	50°55'	110°8'	-	-	-	BO/CO	359C	Modern	-	-	Ronaghan	Large bison eroding from coulee
-	Lyndon Creek Bison Kill	D87-42	50°3'	113°54'	1	35 cm bs	-	BO/CO	454C	*1850	110	-18.9	Brink	-
-	Lyndon Creek Bison Kill	D87-43	50°3'	113°54'	2	70 cm bs	-	BO/CO	455C	*1940	120	-19.1	Brink	-
DgPh-3	Point Beazer	D87-44	49°7'	113°12'	1	40-50 cm	-	BO/CO	456C	*520	100	-17.9	Brink	-
DgPh-3	Point Beazer	D87-45	49°7'	113°12'	2	1 m bs	-	BO/CO	457C	*630	140	-25.0	Brink	-
DgPh-3	Point Beazer	D87-46	49°7'	113°12'	3	1.3 m bs	-	BO/CO	458C	*740	120	-16.5	Brink	-
DjPl-1	Pincher Creek Buffalo Jump	D87-25	49°34'	113°56'	15	150 cm	-	BO/CO	417C	*1420	150	-17.9	Ball 1987; Ball 86-37	-
DjPl-1	Pincher Creek Buffalo Jump	D87-26	49°34'	113°56'	12	120 cm	-	BO/CO	418C	*3000	90	-18.2	Ball 1987; Ball 86-37	-
DjPl-1	Pincher Creek Buffalo Jump	D87-27	49°34'	113°56'	-	0-20 cm	-	BO/CO	419C	*940	110	-19.4	Ball 1987; Ball 86-37	-
DjPl-1	Pincher Creek Buffalo Jump	D87-28	49°34'	113°56'	8,9, 10	80-100 cm	-	BO/CO	420C	*690	90	-18.3	Ball 1987; Ball 86-37	-
DjPl-1	Pincher Creek Buffalo Jump	D87-29	49°34'	113°56'	7.5	75 cm	-	BO/B	421C	*800	80	-23.0	Ball 1987; Ball 86-37	-
DjPl-1	Pincher Creek Buffalo Jump	D87-30	49°34'	113°56'	15	150 cm	-	BO/CO	422C	*2810	90	-18.6	Ball 1987; Ball 86-37	-
DjPl-1	Pincher Creek Buffalo Jump	D87-31	49°34'	113°56'	10	100 cm	-	BO/CO	423C	*1200	90	-18.6	Ball 1987; Ball 86-37	-

Table 13. continued

Site #	Site Name	ASA #	Latitude	Longitude	Level	Depth	Association	Material	AECV #	C-14 date	SD	αC-13 permil (‰)	References & Permit nos.	Comments
DjPl-1	Pincher Creek Buffalo Jump	D87-32	49°34'	113°56'	1-2	0-20 cm	-	BO/CO	424C	*560	90	-20.6	Ball 1987; Ball 86-37	-
DjPl-1	Pincher Creek Buffalo Jump	D87-33	49°34'	113°56'	12	120 cm	-	BO/CO	425C	*1170	100	-18.6	Ball 1987; Ball 86-37	-
DjPl-145	Kettles Jump	D87-48	49°32'	113°50'	-	20-30 cm bs	-	BO/CO	461C	*1140	90	-17.5	Brink	New buffalo jump near Pincher Creek
DjPm-114	Oldman River Dam Project	D86-44	49°36'	114°3'	-	10-30 cm	-	BO/CO	340C	300	90	-	Reeves 1987; Reeves 85-47C	-
DjPm-114	Oldman River Dam Project	D86-45	49°36'	114°3'	-	40 cm	-	BO/CO	341C	1780	150	-	Reeves 1987; Reeves 85-47C	-
DjPm-115	Oldman River Dam Project	D86-50	49°36'	114°3'	-	50 cm	-	WO	346C	110	90	-	Reeves 1987; Reeves 85-47C	-
DjPm-116	Oldman River Dam Project	D86-46	49°36'	114°4'	-	40 cm	-	BO/CO	342C	Modern	-	-	Reeves 1987; Reeves 85-47C	-
DjPm-116	Oldman River Dam Project	D86-47	49°36'	114°4'	-	210 cm	-	BO/CO	343C	1940	160	-	Reeves 1987; Reeves 85-47C	-
DjPm-116	Oldman River Dam Project	D86-48	49°36'	114°4'	-	240 cm	-	BO/CO	344C	2220	110	-	Reeves 1987; Reeves 85-47C	-
DjPm-116	Oldman River Dam Project	D86-49	49°36'	114°4'	-	300 cm	-	WO	345C	2980	90	-	Reeves 1987; Reeves 85-47C	-
DjPm-116	Oldman River Dam Project	D86-55	49°36'	114°4'	-	300 cm	-	BO/CO	347C	1900	180	-	Reeves 1987; Reeves 85-47C	-
DjPm-222	Oldman River Dam Project	D87-18	49°35'	114°1'	-	206 cm	-	WO	405C	*460	90	-23.6	Reeves 1987; Reeves 85-47C	-

Table 13. continued

Site #	Site Name	ASA #	Latitude	Longitude	Level	Depth	Association	Material	AECV #	C-14 date	SD	αC-13 permil (‰)	References & Permit nos.	Comments
DjPm-41	Oldman River Dam Project	D86-37	49°33'	114°1'	-	110 cm	-	BO/CO	333C	2980	110	-	Reeves 1987; Reeves 85-47C	-
DjPm-41	Oldman River Dam Project	D86-38	49°33'	114°1'	-	110 cm	-	BO/CO	334C	880	100	-	Reeves 1987; Reeves 85-47C	-
DjPm-41	Oldman River Dam Project	D86-39	49°33'	114°1'	-	350 cm	-	BO/CO	335C	2270	100	-	Reeves 1987; Reeves 85-47C	-
DjPm-66	Oldman River Dam Project	D86-40	49°36'	114°4'	-	140 cm	-	BO/CO	336C	7790	120	-	Reeves 1987; Reeves 85-47C	-
DjPm-88	Oldman River Dam Project	D86-41	49°37'	114°3'	-	40 cm	-	BO/CO	337C	1680	100	-	Reeves 1987; Reeves 85-47C	-
DjPm-88	Oldman River Dam Project	D86-42	49°37'	114°3'	-	70 cm	-	BO/CO	338C	1470	90	-	Reeves 1987; Reeves 85-47C	-
DjPm-88	Oldman River Dam Project	D86-43	49°37'	114°3'	-	110 cm	-	BO/CO	339C	2650	100	-	Reeves 1987; Reeves 85-47C	-
DkPj-1	Head-Smashed-In Buffalo Jump	D87-6	49°43'	113°39'	-	6-7 ft. bs	-	BO/CO	357C	3790	190	-	Brink	Redates terminal Mummy Cave at kill site
DkPj-1	Head-Smashed-In Buffalo Jump	D87-15	49°43'	113°39'	2,3	-	OW	BO/CO	374C	*800	90	-20.0	Brink et al. 1987; Brink and Dawe 1988; Brink 86-28	-
DkPj-1	Head-Smashed-In Buffalo Jump	D87-16	49°43'	113°39'	3,4	-	?AV	BO/CO	375C	*1360	140	-19.4	Brink et al. 1987; Brink and Dawe 1988; Brink 86-28	-
DkPj-27	Calderwood Buffalo Jump	D87-3	49°43'	113°39'	Two	30 cm DBS	-	BO/B	363C	*1290	90	-21.4	Marshall 86-32	-

Table 13. continued

Site #	Site Name	ASA #	Latitude	Longitude	Level	Depth	Association	Material	AECV #	C-14 date	SD	αC-13 permil (‰)	References & Permit nos.	Comments
DkPj-27	Calderwood Buffalo Jump	D87-2	49°43'	113°39'	Two	30 cm DBS	-	BO/B	362C	*1380	90	-26.4	Marshall 86-32	-
DkPj-27	Calderwood Buffalo Jump	D87-1	49°43'	113°39'	Two	30 cm DBS	-	BO/B	361C	*1460	120	-21.0	Marshall 86-32	-
DkPj-27	Calderwood Buffalo Jump	D87-8	49°43'	113°39'	Three	-	-	BO/CO	367C	*2170	90	-17.5	Marshall 86-32	-
DkPj-27	Calderwood Buffalo Jump	D87-9	49°43'	113°39'	Three	50 cm	-	BO/CO	368C	1530	90	-	Marshall 86-32	-
DkPj-27	Calderwood Buffalo Jump	D87-10	49°43'	113°39'	Three	50 cm	-	BO/B	369C	*1910	90	-24.3	Marshall 86-32	-
DkPj-27	Calderwood Buffalo Jump	D87-11	49°43'	113°39'	Four	80 cm	-	BO/CO	370C	2310	100	-	Marshall 86-32	-
DkPj-27	Calderwood Buffalo Jump	D87-13	49°43'	113°39'	Four	80 cm	-	BO/B	372C	*2860	170	-24.1	Brink and Dawe 1988; Marshall 86-32	-
DkPj-27	Calderwood Buffalo Jump	D87-14	49°43'	113°39'	Four	140 cm	-	BO/CO	373C	*2910	90	19.8	Brink and Dawe 1988; Marshall 86-32	-
DkPj-27	Calderwood Buffalo Jump	D87-47A	49°43'	113°39'	1-2	-	-	BO/CO	459C	*260	130	-19.9	Brink	Redates upper kill
DkPj-27	Calderwood Buffalo Jump	D87-47B	49°43'	113°39'	1-2	-	-	BO/CO	460C	*200	120	-19.4	Brink	Redates upper kill
DlPb-2	Cranford Gravel Pit	D87-61	49°50'	112°20'	5	22-24 cm	-	CH/MX	475C	*2550	90	-23.8	Stuart 87-57C	-
FdOt-9	Wells	D87-57	52°40'	111°20'	2	11 cm	-	BO/CO	471C	*1030	150	-20.6	Stuart 1988; Stuart 87-34	-

Table 13. continued

Site #	Site Name	ASA #	Latitude	Longitude	Level	Depth	Association	Material	AECV #	C-14 date	SD	αC-13 permil (%.)	References & Permit nos.	Comments
FeOm-1	Folkins Lake Burial	D87-19	52°42'	110°5'	-	50-55 cm bs	-	BO/CO	406C	*1460	100	-19.8	Ball and Beattie 1987; Ball 86-57	-
FjPi-29	Strathcona	D87-34	53°33'	113°23'	D	10-15 cm	-	CH	426C	Modern		-	Kooyman 1988; Kooyman 87-24	UN - bomb contamination
PALAEO	Buck Lake	D87-17A	53°0'	114°47'	-	6.77-6.82 m	PAL	CS	394C	*5560	200	-29.2	Beaudoin	-
PALAEO	Buck Lake	D87-17B	53°0'	114°47'	-	6.82-6.87 m	PAL	CS	395C	*6390	170	-17.5	Beaudoin	-
PALAEO	Moore Lake	D87-20	54°30'	110°32'	-	3.60-3.65 m	PAL	CS	409C	*6420	160	-26.4	Schweger and Hickman	-
PALAEO	Moore Lake	D87-21	54°30'	110°32'	-	4.15-4.20 m	PAL	CS	410C	*7650	130	-28.0	Schweger and Hickman	-
PALAEO	Moore Lake	D87-22	54°30'	110°32'	-	5.175-5.225 m	PAL	CS	411C	*11830	330	-21.0	Schweger and Hickman	-
PALAEO	Lorraine Lake	D87-35	52°45'	117°40'	-	116-118 cm	PAL	CS	429C	*6310	190	-32.6	Bear	-
PALAEO	Lorraine Lake	D87-36	52°45'	117°40'	-	124-131 cm	PAL	CS	430C	*6980	150	-23.2	Bear	-
PALAEO	Lorraine Lake	D87-37	52°45'	117°40'	-	262-268 cm	PAL	CS	431C	*12350	440	-32.7	Bear	-
PALAEO	Fickle Lake	D87-38	53°4'	117°0'	-	235.5-239.5 cm	PAL	CS	432C	*8220	120	-31.4	Goldsborough	-
PALAEO	Fickle Lake	D87-39	53°4'	117°0'	-	155.5-159.5 cm	PAL	CS	433C	*6330	120	-30.2	Goldsborough	-

Table 13. continued

Site #	Site Name	ASA #	Latitude	Longitude	Level	Depth	Association	Material	AECV #	C-14 date	SD	αC-13 permil (‰)	References & Permit nos.	Comments
PALAEO	Nordegg Bridge Section	D87-40	52°24'	116°5'	-	255-265 cm	PAL	CH/Coal	434C	*>40620	-	-24.8	Ronaghan and Beaudoin, this volume; Ronaghan 87-37	UN - coal contamination
PALAEO	Bushe River Bison	D87-41	58°30'	117°0'	-	Approx. 4 m	PAL	BO/CO	439C	*10080	150	-19.3	Wright	-
PALAEO	"Brian's Creek"	D87-49	52°0'	116°33'	-	4.25 m	PAL	CH	463C	*6720	150	-20.9	Ronaghan and Beaudoin, this volume; Ronaghan 87-37	-
PALAEO	"Wood Bog"	D87-23	55°9'	118°43'	-	c. 2 m	PAL	WO	412C	*9250	130	-24.2	Beaudoin	-
PALAEO	"Wood Bog"	D87-24	55°9'	118°43'	-	c. 2 m	PAL	WO	413C	*9160	130	-25.5	Beaudoin	-
PALAEO	"Wood Bog"	D87-50	55°9'	118°43'	-	15-20 cm	PAL	PE	464C	*1240	100	-26.4	Beaudoin	-
PALAEO	"Wood Bog"	D87-51	55°9'	118°43'	-	40-45 cm	PAL	PE	465C	*2130	100	-25.1	Beaudoin	-
PALAEO	"Wood Bog"	D87-52	55°9'	118°43'	-	c. 40-45 cm	PAL	PE	466C	*2400	100	-25.1	Beaudoin	-
PALAEO	"Wood Bog"	D87-53	55°9'	118°43'	-	c. 90-95 cm	PAL	PE	467C	*4300	100	-27.1	Beaudoin	-
PALAEO	"Wood Bog"	D87-54	55°9'	118°43'	-	c. 135-140 cm	PAL	PE	468C	*6770	440	-28.5	Beaudoin	-
PALAEO	"Wood Bog"	D87-55	55°9'	118°43'	-	c. 210-220 cm	PAL	WO	469	*9290	140	-26.0	Beaudoin	-
PALAEO	"Wood Bog"	D87-56	55°9'	118°43'	-	c. 270-275 cm	PAL	WO	470C	*9630	650	-25.3	Beaudoin	-

ABSTRACTS FOR 1987 PERMITS

Compiled by
Martina Purdon

We are pleased to be able to present abstracts for all permits issued in 1987. We thank all those permit holders who submitted abstracts by our publication deadline.

87-1

Glenn S.L. Stuart
Ethos Consultants Ltd.
Group Box 20, Veinerville
Medicine Hat, Alberta

Canadian Western
Natural Gas
Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline is located in the short grass prairie zone of southeastern Alberta, about 5 km northeast of Foremost. Approximately 85 percent of the ground surface examined had been cultivated.

METHODOLOGY: Two sections of a proposed pipeline right-of-way (totalling approximately 50 ha) were examined by foot and vehicular traverses and inspection of rodent holes, deflated areas, eroded slopes and other existing ground disturbances. When an archaeological site was encountered, the immediate vicinity was throughly examined to ascertain its nature and extent and the probable impact of the proposed development.

RESULTS: Two previously unrecorded archaeological sites (DiOu-13 and DkOv-3) were located, and one previously recorded historical site was relocated. Recommendations included realigning the pipeline right-of-way to avoid site DkOv-3 and undertaking a mapping, testing and excavation programme at DiOu-13. It was determined that the historical site would not be impacted by the development.

SITE TYPES: Stone circles, historical cemetery

REPORT: Complete, entitled "An Historical Resource Impact Assessment of a Canadian Western Natural Gas Company Ltd. Pipeline Development A.S.A. Permit 87-1 - Final Report," by Glenn S.L. Stuart

87-2

Rebecca J. Balcom
Environmental Management
Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

Poco Petroleums Ltd.
Rumsey Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline is located in knob-and-kettle terrain, 11 km northeast of Rumsey and 95 km southeast of Red Deer. The pipeline is 4 km in length.

METHODOLOGY: The impact assessment was done under winter conditions. Field techniques consisted of visual examination of the right-of-way with snow removal where appropriate.

RESULTS: Two sites were recorded. ElPe-25 consists of three tipi rings and a cairn. All features will be avoided by the proposed development. Site ElPe-26 consists of two cairns located on either side of the right-of-way. It was recommended that development be allowed to proceed.

SITE TYPES: Stone features

REPORT: Complete, entitled "Historical Resources Impact Assessment Rumsey Pipeline Final Report, Permit 87-2," by Rebecca J. Balcom

87-3

Glenn S.L. Stuart
Ethos Consultants Ltd.
Group Box 20, Veinerville
Medicine Hat, Alberta

Bow Valley Industries
Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline right-of-way is located approximately 8 km north of Etzikom, in an area of short grass prairie. Approximately 40 percent of the ground surface examined has been cultivated.

METHODOLOGY: Examination of all development areas involved foot traverses and, in uncultivated areas, examination of rodent holes, deflated areas, eroded slopes and other existing ground disturbances. When an archaeological site was encountered, the immediate vicinity was throughly examined to ascertain its nature and extent and the probable impact of the proposed development.

RESULTS: One previously unrecorded archaeological site (DjOs-14) was located. It was recommended that the pipeline right-of-way be realigned to avoid this site.

SITE TYPES: Stone circle

REPORT: Complete, entitled "An Historical Resource Impact Assessment of a Bow Valley Industries Ltd. Pipeline Development A.S.A. Permit 87-3 - Final Report," by Glenn S.L. Stuart

87-4

Rebecca J. Balcom
Environmental Management
Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

NOVA Corporation
of Alberta
Queenstown Lateral
Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline is located north of Milo, to the south and west of the Majorville Cairn.

METHODOLOGY: Uncultivated segments (totalling 4.6 km) of a 41.3 km pipeline were examined by foot traverses, shovel tests and inspection of fortuitous exposures.

RESULTS: One site, EdPd-20, was found.

SITE TYPE: Small lithic scatter

REPORT: Complete, entitled "Historical Resources Impact Assessment Queenstown Lateral Pipeline," by Rebecca J. Balcom

87-5

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

Martin and Company
Residential Development
Lethbridge

PROJECT TYPE: Conservation evaluation studies at DkPf-15

LOCATION/SETTING: The site is situated on the west side of the Oldman River in the Westview area of Lethbridge.

METHODOLOGY: Excavation of 2 x 2 m tests were conducted in one of two rings and at one of two hearths. The two rings and four cairns were mapped, and surface materials were collected.

RESULTS: Sixty-five lithic artifacts were recovered, including 16 tools.

SITE TYPE: Stone feature/campsite

DATE: The site was assigned to the Late Middle Prehistoric Period on the basis of one Hanna-type projectile point.

REPORT: Complete, entitled "Final Report Conservation Evaluation Studies DkPf-15," by Bea Loveseth

87-6

S.G. Saylor
918 Victoria Avenue
Saskatoon, Saskatchewan

Alberta Transportation
Gravel Pits/
Highway Construction

PROJECT TYPE: HRIA

LOCATION/SETTING: Various areas in southern and central Alberta: (1) Pratt Pit No. 2, near Cardston; (2) SR 785:02 near Fort Macleod; (3) Robinson Pit near Cochrane; (4) SR 599:06 near Coronation; and (5) North Ram Pit near Nordegg

METHODOLOGY: Each development area was examined by systematic foot traverses, for purposes of discovering surface features, and shovel testing to determine the presence of buried cultural material.

RESULTS: (1) Pratt Pit: two stone circle sites were recorded adjacent to, but outside, the gravel pit. (2) SR 785:02: a total of four previously unrecorded sites (one isolated find, one cairn, one lithic scatter and historical structural remains) and an extension of Head-Smashed-In Buffalo Jump were assessed. (3) Robinson Pit: seven stone circle sites, a lithic scatter and historical farm remains were investigated. (4) SR 599:06: no sites were recorded during the HRIA. (5) North Ram Pit: no sites were recorded during the HRIA.

REPORT: Complete, entitled "Final Report, Historical Resources Impact Assessment of Alberta Transportation Aggregate Extraction and Highway Construction Projects, A.S.A. Permit 87-6," by Stanley G. Saylor

87-7

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

Hardy BBT Limited
Gas Pipeline System

PROJECT TYPE: HRIA, test excavations, surface collection and monitoring at GaPr-7

LOCATION/SETTING: The pipeline is located near Mayerthorpe in the interior plains of north central Alberta. Terrain varies from flat to rolling. The area includes a mixed wooded section of the boreal forest, with aspen, birch and conifers in well-drained localities and black spruce and tamarack in muskeg. Much of the land is agricultural.

METHODOLOGY: The project included foot traverses and extensive shovel tests of entire 30 km long, 15 m wide right-of-way, and shovel tests, systematic surface collection, mapping and monitoring of a segment of GaPr-7 within pipeline right-of-way.

RESULTS: Ten prehistoric sites were located; 76 artifacts were recovered in shovel tests (50 x 50 cm), 156 from surface collection and 64 in monitoring at GaPr-7.

SITE TYPES: Three campsites (GaPr-7 to 9), four lithic scatters (FlPr-2, FlPs-18 and 20 and GaPr-6) and three isolated finds (FlPs-17, 19 and 21) were located.

CULTURAL AFFILIATION: Pelican Lake (FlPs-19), Oxbow Complex (GaPr-7 and 9)

REPORT: Complete, entitled "Historical Resources Impact Assessment and Conservation Studies, Canadian Occidental Heldar Gas Pipeline System," by Bea Loveseth

87-8

Thomas Head
Bison Historical Services
236 - 11A Street, N.W.
Calgary, Alberta

Lacombe Fish and Game
Association
Burbank Park

PROJECT TYPE: HRIA

LOCATION/SETTING: The multiuse park facilities are located at confluence of Blindman and Red Deer rivers and constitute an area of about 5 ha.

METHODOLOGY: Foot traverses, complemented by shovel testing were conducted in areas of moderate and high potential for archaeological sites.

RESULTS: One prehistoric site (FcPk-30) and one historical site were located. FcPk-30 consists of fire-broken rock, a single quartzite flake and bone in rodent spoil piles in area of cultivation. The historical site consists of facilities associated with the Blindman River Electric Power Company Power Plant (1906-1915).

SITE TYPES: Disturbed campsite (FcPk-30) and historical facilities, including diversion ditch, power plant and house depression

REPORT: Complete, entitled "Final Report, Historical Resources Impact Assessment, Burbank Park ASA Project Number 87-8," by Thomas Head

87-9	Thomas Head Bison Historical Services 236 - 11A Street, N.W. Calgary, Alberta	Alberta Municipal Affairs, ID 17(E) Wabasca/Desmarais Water Storage Reservoir

PROJECT TYPE: HRIA

LOCATION/SETTING: The 5 ha project area is located on north end of South Wabasca Lake, on and behind an alluvial terrace.

METHODOLOGY: The study area was foot traversed, and shovel tests were dug in areas with archaeological potential. Archival studies of historical remains were also conducted.

RESULTS: One prehistoric site (GlPk-1) and one historical site were recorded. GlPk-1 is associated with a high, southeast to northwest trending beach ridge. Five of six shovel tests on site were positive and contained chert and quartzite debitage along with bone and fire-broken rock. The bone was identified as large mammal, small mammal and fish. St. Martins Mission facilities are located adjacent to proposed water storage area. Observed historical materials include concrete slab floor (barn) and piled foundations related to unknown structures.

SITE TYPES: Campsite (GlPk-1) and St. Martins Mission

REPORT: Complete, entitled "Final Report, Historical Resources Impact Assessment, Wabasca/Desmarais, Lot 26, ASA Project Number 87-9," by Thomas Head

87-10	Terrance H. Gibson 9932 - 112 Street Edmonton, Alberta	City of Wetaskiwin Peace Hills Park

PROJECT TYPE: HRIA

LOCATION/SETTING: Project area is located 2 km northwest of Wetaskiwin in Peace Hills Park.

METHODOLOGY: The entire park (covering a quarter section) was judgementally examined by surface inspection, shovel testing and visual inspection of existing exposures. The known archaeological sites were retested. One site, FfPi-1, known as the Fullerton site, was extensively examined with deep shovel tests. A 1 x 1 m test unit was excavated in arbitrary levels to 150 cm below ground surface.

RESULTS: Site FfPi-2 could not be relocated because of continued development in its vicinity. Site FfPi-3 was found to be largely disturbed by sand quarrying. At site FfPi-1, shovel tests indicated that a strip of the site at least 3 m wide and 100 m long remained undisturbed. The test excavation demonstrated that over 70 cm of intact and productive archaeological deposits were present on some parts of the site. It was recommended that the site be avoided during development and that vehicle traffic be re-routed away from the site. No new sites were found in the park area.

SITE TYPE: Prehistoric, stratified, multi-component campsite

REPORT: Complete, entitled "Project 87-10 Historical Resources Impact Assessment of Peace Hills Park, Wetaskiwin, Alberta," by Terrance H. Gibson

87-11

Barry J. Dau
Ethos Consultants Ltd.
Group Box 20, Veinerville
Medicine Hat, Alberta

Canadian Western
Natural Gas Company
Stone Circle Mitigation

PROJECT TYPE: Research at site DiOu-13

LOCATION/SETTING: Site DiOu-13 is situated on the southern rim of Chin Coulee, approximately 3500 m east-northeast of the town of Foremost.

METHODOLOGY: The project consisted of the detailed auger testing and test excavation of four of the 16 stone circles at site DiOu-13. These four features are threatened with impaction by the construction of a gas transmission line across Chin Coulee. A total of 20 square metres were excavated at the site.

RESULTS: A total of 59 pieces of cultural material and single feature (a surface hearth) were recovered from auger testing and test excavation. No diagnostic materials were found. At the outset of the project, the general location and observed surface components of the site suggested that it represented a short-term, non-winter campsite. The results of the excavation programme tend to support this view.

REPORT: Complete, entitled "An Historic Resources Mitigation Project at Archaeological Site DiCu-13, near Foremost, Southeastern Alberta - A.S.A. Permit #87-11," by Barry J. Dau

87-12

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

Coscan Development Corporation
Residential Subdivision

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed subdivision is located in the city of Calgary, on an upland zone of a preglacial escarpment with seasonal drainages in coulees. Vegetation is mainly native grassland on upland and aspen groves in coulees and moisture accumulation areas.

METHODOLOGY: Foot traverses of 21.08 ha of development land were conducted, with extensive shovel testing in areas were ground visibility was poor.

RESULTS: Three prehistoric sites and one historical site were identified.

SITE TYPES: Tipi ring (EgPn-320), lithic scatter (EgPn-318), isolated find (EgPn-319) and historical residence (Christie)

DATE: 1920s for the Christie residence

REPORT: Complete, entitled "Historical Resources Impact Assessment, Proposed Subdivision, The Christie Estate," by Bea Loveseth

87-13

Edward J. McCullough
Fedirchuk McCullough & Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

Federated Pipe Lines Ltd.
Acheson Pipeline Extension

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed pipeline project is situated north and west of Edmonton, within the parkland region of western Alberta.

METHODOLOGY: Areas priorized as medium and high potential were investigated. Fortuitous exposures and ploughed fields were examined, and shovel tests were used to identify the presence of prehistoric cultural materials.

RESULTS: Previously recorded sites, FjPk-5 and 14, were revisited. No additional material was observed. Six prehistoric sites (FjPk-20 to 23 and FkPk-1 and 2) were recorded.

SITE TYPES: Isolated finds (FjPk-20, 21 and 23 and FkPk-1), artifact scatter (FkPk-2), and campsites (FjPk-22)

REPORT: Complete, entitled "Historical Resources Impact Assessment Federated Pipe Lines Ltd. Acheson Pipeline Extension Project," by Edward J. McCullough

87-14	**Thomas Head** **Bison Historical Services** **236 - 11A Street, N.W.** **Calgary, Alberta**	**Tintagel Energy Corporation** **Well Site and Access Road**

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed well site is located on high terrace on west side of Willow Creek, approximately 16.5 km from Drumheller. It comprises areas of 1 ha undisturbed (well site) and 2.85 ha cultivated (access road) land.

METHODOLOGY: Foot traverses of the entire area and systematic shovel testing in areas of moderate and high archaeological potential were conducted.

RESULTS: Sites EiPc-6 and 7 were identified, assessed and recorded. EiPc-6 consists of surficial lithic scatter and fire-broken rock along a north-facing terrace edge in well site area. EiPc-7 consists of fire-broken rock, quartzite debitage and petrified wood debitage in a cultivated field on and adjacent to access road at the east end of field.

SITE TYPES: Campsites

REPORT: Complete, entitled "Final Report, Historical Resources Impact Assessment, Wellsite LSD 5 and 6, Section 22, Twp. 28, Rge. 18, W4M. ASA Project Number 87-14," by Thomas Head

87-15	**Thomas Head** **Bison Historical Services** **236 - 11A Street, N.W.** **Calgary, Alberta**	**Alberta Municipal Affairs, ID 17(E)** **Water Reservoir** **Mitigation, GlPk-1**

PROJECT TYPE: Mitigation of impacts, excavation at site GlPk-1

LOCATION/SETTING: The site is located on a beach ridge on the north shore of South Wabasca Lake adjacent to Desmarais. The site area is treed and fronted by a cobble ice pushed ridge.

METHODOLOGY: Eight square metres were excavated, seven of these on the most productive shovel tests and one on an alternate positive shovel test. Provenience was 50 x 50 cm horizontally and 10 cm vertically. Soil was screened.

RESULTS: Three hundred and twenty-three artifacts, including 66 historical artifacts (component 1) and 257 prehistoric artifacts (component 2) were recovered. Twenty-five tools, including three side-notched points (two with indented bases) were located. The assemblage also includes wedges, bifaces, a uniface and a variety of specimens exhibiting evidence of a bipolar technology. Faunal assemblage (n=500) consists of *Lepus*, *Cervidae*, *Ursus*, *Castor*, piscean species and molluscan species.

SITE TYPE: Buried campsite

REPORT: Complete, entitled "Final Report, Historical Resources Mitigation, GlPk-1, Wabasca/Desmarais, Lot 26, ASA Project Number 87-15," by Thomas Head

87-16

Stanley Van Dyke
Bison Historical Services
236 - 11A Street, N.W.
Calgary, Alberta

Placer Cego Petroleum
Elnora Area Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The north to south sales pipeline and gathering system is located west of the Red Deer River and 13.5 km east of the town of Elnora. The 8.5 km of the right-of-way examined lies in hummocky parkland terrain.

METHODOLOGY: Comprehensive foot traverses with systematic and judgemental shovel testing were conducted.

RESULTS: A single prehistoric site (ElPg-12), consisting of a lithic scatter and fire-broken rock, was located. Lithic remains consisted of cores and cortical flakes. The surface is disturbed, and the four shovel tests were negative.

SITE TYPE: Disturbed campsite

REPORT: Complete, entitled "Final Report, Historical Resources Impact Assessment, Elnora Area Pipeline Project 098A. ASA Project Number 87-16," by Stanley Van Dyke

87-17

Rebecca J. Balcom
Environmental Management Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

Shorty Heringer
Paradise Valley Par 3 Golf Course Extension

PROJECT TYPE: HRIA

LOCATION/SETTING: The golf course is located south of the downtown core of Medicine Hat in Seven Persons Coulee. The area is about 6 ha and is intersected by Seven Persons Creek. Vegetation is typical prairie river valley.

METHODOLOGY: Field techniques involved closely spaced foot traverses, visual inspection of exposures, shovel testing and backhoe testing.

RESULTS: One site, EaOq-42, was found. Three cores and four flakes were found on the surface, and glass fragments were found in shovel tests. This area has been severely disturbed.

SITE TYPE: Lithic scatter

REPORT: Complete, entitled "Historical Resources Impact Assessment Paradise Valley Par 3 Golf Course Extension Final Report, Permit 87-17," by Rebecca J. Balcom

87-18

Barry J. Dau
Ethos Consultants Ltd.
Group Box 20, Veinerville
Medicine Hat, Alberta

Alberta Environment
Proposed Developments Associated with Oldman River Dam

PROJECT TYPE: HRIA

LOCATION/SETTING: The project area is located within and immediately adjacent to the reservoir basin for the Oldman River Dam and downstream from the proposed dam site.

METHODOLOGY: The 1987 Oldman River Dam HRIA programme involved four projects. Project 1 consisted of the examination of areas intended for shelterbelt development and secondary stockpiling of topsoil. Project 2 involved the assessment of a proposed dam site viewpoint and the examination of two recently abandoned historical farmsteads (Robert Day and Bougerolle properties). Project 3 consisted of the assessment of two proposed borrow areas downstream from the dam site. Project 4 involved the assessment of four proposed road links around the perimeter of the reservoir.

RESULTS: During the course of the four projects, a total of 11 prehistoric sites were identified and assessed. Two of these (DjPl-16 and 136) had been recorded during earlier HRIAs at the Oldman River Dam. The remainder (DjPk-79 and 80 and DjPl-137 to 143) were previously unrecorded sites.

At the Bougerolle property, a stove and caldron combination from the Schuratoff Bath House and a small, pointed bench were recovered and stored to protect them from unauthorized collectors. No items of possible historical significance were found at the Robert Day property.

SITE TYPES: Stone circles, cairns, buried camps, historical farmsteads

REPORT: Complete, entitled "1987 Historic Resource Impact Assessments at the Oldman River Dam, Alberta - ASA Permit 87-18," by Barry J. Dau

87-19

Edward J. McCullough
Fedirchuk McCullough & Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

Petro-Canada Inc.
Keystone Pipeline Project

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed pipeline project is situated southwest of Edmonton. The project lies within the boreal-cordilleran zone of western Alberta.

METHODOLOGY: Examination of fortuitous exposures and ploughed fields and excavation of shovel tests were used to identify the presence of prehistoric cultural materials.

RESULTS: Five prehistoric sites (FgPp-19 to 22 and FgPo-4) were recorded.

SITE TYPES: Isolated find (FgPp-20), artifact scatters (FgPp-21 and 22) and campsites (FgPo-4 and FgPp-19)

REPORT: Complete, entitled "Historical Resources Impact Assessment Petro-Canada Inc. Keystone Pipeline Project," by Edward J. McCullough

87-20	**Gloria J. Fedirchuk** **Fedirchuk McCullough & Associates Ltd.** **304, 1725 - 10 Avenue, S.W.** **Calgary, Alberta**	**Korite Limited** **Ammolite Mine**

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed ammolite mine area is situated southwest of Lethbridge on the St. Mary River. The project lies within the mixed prairie region of western Alberta.

METHODOLOGY: Examination of fortuitous exposures and excavation of shovel tests were used to identify the presence of prehistoric cultural materials.

RESULTS: One prehistoric site (DjPf-113) was recorded.

SITE TYPE: Complex stone feature site, containing an oval stone feature thought to represent a vision quest, a stone circle and an artifact scatter

REPORT: Complete, entitled "Historical Resources Impact Assessment Korite Limited Ammolite Mine," by Gloria J. Fedirchuk

87-21	**Terrance H. Gibson** **9932 - 112 Street** **Edmonton, Alberta**	**Mackenzie Regional** **Planning Commission** **Recreation Sites**

PROJECT TYPE: HRIA

LOCATION/SETTING: Investigations were conducted in the upper Peace River region near Fairview, between Silver Valley and Eaglesham, at five proposed day-use parks located beside the Peace River.

METHODOLOGY: All five day-use areas were examined by surface inspection, shovel testing and visual inspection of existing exposures.

RESULTS: No new sites were located during the investigation. An existing site, HaQw-3, located at the mouth of Sneddon Creek on the Cotillion day-use area, was relocated and intensively assessed. The archaeological deposit was found to be unusually well preserved, containing a diversity of lithic artifacts. Since much of the site was to be impacted by day-use expansion, it was recommended that certain parts of the site avoided and others excavated as required.

SITE TYPE: Prehistoric, multi-component campsite

REPORT: Complete, entitled "Project 87-21, Historical Resources Impact Assessment of Proposed Recreation Sites along the Upper Peace River, Fairview, Alberta," by Peter T. Bobrowsky and Terrance H. Gibson

87-22	Bea Loveseth Lifeways of Canada Ltd. 317 - 37 Avenue, N.E. Calgary, Alberta	Alberta Transportation/ Alberta Recreation and Parks Highway and Recreational Developments

PROJECT TYPE: HRIA

LOCATION/SETTING: The project included SR 584 west of Sundre, Beauvais Lake Provincial Park west of Pincher Creek, William A. Switzer Provincial Park northwest of Hinton, and Thunder Lake Provincial Park west of Barrhead. The first three are in the forested Rocky Mountain Foothills, and the fourth is in the woodland boreal forest.

METHODOLOGY: Foot traverse and shovel testing of proposed highway alignment and recreational developments and assessment of GaPl-8 to 10 at Thunder Lake Provincial Park were conducted.

RESULTS: No sites were located in the right-of-way of SR 584, Beauvais Lake or William A. Switzer provincial parks. Two new sites were recorded at Thunder Lake Provincial Park.

SITE TYPES: Lithic scatter (GaPq-19) and multi-component campsite (GaPq-20)

REPORT: Complete, entitled "Final Report, Historical Resources Impact Assessment SR 584:02, Beauvais Lake Provincial Park, William A. Switzer Provincial Park and Thunder Lake Provincial Park (ASA Permit 87-22)," by Bea Loveseth

87-23

Rebecca J. Balcom
Environmental Management Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

Poco Petroleums Ltd.
Big Valley and Rumsey Pipelines

PROJECT TYPE: Historical resources reconnaissance and impact assessment

LOCATION/SETTING: The Big Valley pipeline is approximately 12.8 km in length and crosses the Red Deer River north of the Dry Island Buffalo Jump and west of Big Valley. The terrain is generally flat and is either cultivated or has the typical vegetation of aspen parkland. The Rumsey pipeline is 28 km in length and is located in knob-and-kettle terrain northeast of the town of Rumsey. Vegetation is typical native short grass prairie.

METHODOLOGY: Field techniques involved a preliminary reconnaissance to assist in selecting the route across the Red Deer River. This was followed by foot traverses, examination of exposures and shovel testing.

RESULTS: Two sites were recorded on the Big Valley pipeline (FaPf-9 and 10). One was a small find and the other was a lithic scatter. Both were in disturbed contexts, and development has proceeded. Eleven sites were recorded on the Rumsey pipeline (ElPe-27 to 34 and ElPd-11 to 13). They are single tipi rings, multiple tipi rings, cairns and an isolated find. The sites on this pipeline have been avoided.

SITE TYPES: Stone features, small finds and a lithic scatter

REPORT: In preparation

87-24

Brian Kooyman
Department of Archaeology
University of Calgary
Calgary, Alberta

Alberta Culture and Multiculturalism
Strathcona Site

PROJECT TYPE: Research/archaeology field school; continuing excavations at FjPi-29

LOCATION/SETTING: The Strathcona site is located on the east side of the North Saskatchewan River, in the county of Strathcona, near the eastern limits of the city of Edmonton

METHODOLOGY: A 38-square metre block excavation was undertaken in a portion of the site suspected of being a habitation area, based on the previous season's excavation. The excavation area extended north and east from the 1986 excavation. Excavation was by trowel; all material was sieved through 1/4 inch screens; a 1 percent sample was processed through 1 mm screens.

RESULTS: Some 3,000 to 4,000 pieces of cultural material were recovered, mostly lithic debitage and small bone fragments. McKean, Hanna and Pelican Lake projectile points were included in the assemblage. A hearth was located in the excavation, but the radiocarbon date obtained indicated the sample had become contaminated in some manner.

SITE TYPE: Habitation site, possible lithic workshop

DATES: Middle and Late Prehistoric, from contact through to ca. 4,000 or 5,000 years B.P., based on radiocarbon dates and projectile point typology

REPORT: Complete, entitled "Final Report of the 1987 University of Calgary Archaeology Field School at the Strathcona Site (FjPi-29)," by Brian Kooyman

87-25	**Edward J. McCullough** **Fedirchuk McCullough & Associates Ltd.** **304, 1725 - 10 Avenue, S.W.** **Calgary, Alberta**	**Interprovincial Pipe Lines Limited** **Pipeline Replacement**

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed pipeline project commences at Edmonton, crosses the Alberta/Saskatchewan border near Provost, and continues to Regina, Saskatchewan. The project lies within the parkland region.

METHODOLOGY: An HRIA was required of only one area (called a target area) in the Alberta section. All fortuitous exposures, including ploughed surfaces and disturbance created by pipeline construction, were examined, and shovel tests were excavated in areas of limited visibility to identify the presence of prehistoric cultural materials.

RESULTS: Four previously recorded prehistoric sites (FdOt-1, 6, 9 and 10) were assessed relative to the development project. A possible hearth was identified within the development zone at FdOt-1. A wide scatter of cultural material was identified within the development zone at FdOt-9.

SITE TYPES: Campsites

DATE: Middle Prehistoric

REPORT: Complete, entitled "Historical/Heritage Resources Impact Assessment Interprovincial Pipe Lines Limited Line 1 Pipeline Replacement Project," by Edward J. McCullough and Gloria J. Fedirchuk

87-26	**Gloria J. Fedirchuk** **Fedirchuk McCullough & Associates Ltd.** **304, 1725 - 10 Avenue, S.W.** **Calgary, Alberta**	**Morrison Petroleums Ltd.** **Hays Well Site and Access Road**

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed well site is situated north and west of Hays, Alberta and on the south bank of the Bow River. The project lies within the mixed prairie region of eastern Alberta.

METHODOLOGY: Stone circles in the development zone were reported by the legal surveyors. The pristine area of the well site and the ploughed access road were examined for surficial features and prehistoric cultural materials. Shovel tests were excavated within the well site area. The site area was mapped.

RESULTS: A complex stone feature site, EaOx-1, was recorded.

SITE TYPE: Complex stone feature site, containing seven stone circles, three cairns and four other rock features, in addition to a wide-spread scatter (ca. 120 x 225 m) of both buried and surficial fire-broken rock, cores and flakes

DATE: Late Prehistoric, based on one small, side-notched projectile point fragment recovered from access road

REPORT: Complete, entitled "Historical Resources Impact Assessment Morrison Petroleums Ltd. Hays Well Site and Access Road," by Gloria J. Fedirchuk

87-27	Terrance H. Gibson 9932 - 112 Street Edmonton, Alberta	NOVA Corporation of Alberta Howard Creek East and Silverwood Lateral Pipelines

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline is located between 2 and 12 km east and south of the town of Spirit River.

METHODOLOGY: A foot (surface inspection and shovel testing) survey was undertaken on the entire length of the proposed Howard Creek East Lateral (7.4 km) and Silverwood Lateral (4.3 km) pipeline routes.

RESULTS: The survey revealed two previously unrecorded archaeological sites on the alignment route. Both were found within the boundaries of the Spirit River Indian Settlement. Site GkQq-4, located on the north side of the Spirit River, was found to be largely destroyed by cultivation and bulldozing. In addition to the prehistoric materials, a few historical items were discovered, as was the outline of a former building. Site GkQq-5, located on the south side of the river, consisted of a small collection of historical artifacts recovered from the ground surface. Neither site required further study.

SITE TYPES: Prehistoric and historical

REPORT: Complete, entitled "Project 87-27 Historical Resources Impact Assessment of the Howard Creek East Lateral and Silverwood Lateral Pipelines, Spirit River, Alberta," by Terrance H. Gibson

87-28	Thomas Head Bison Historical Services 236 - 11A Street, N.W. Calgary, Alberta	Tintagel Energy Corporation Well Sites and Access Road

PROJECT TYPE: HRIA

LOCATION/SETTING: The project is located in an area of disturbed grasslands (cultivated) north and east of Drumheller and is associated with major coulee edges.

RESULTS: Results included identification, assessment and recording of two prehistoric sites (ElPc-8 and 9) adjacent to well site access road and one prehistoric site (ElPc-10) on well site. The well site was subsequently moved to avoid impacts to these sites.

SITE TYPES: Isolated find (ElPc-8), cairns (ElPc-9), isolated tipi ring and lithic scatter (ElPc-10)

REPORT: Complete, entitled "Final Report, Historical Resources Impact Assessment, Wellsites LSD 10-24-28-18-W4M and 8-35-28-18-W4M, ASA Project Number 87-28," by Thomas Head and Stanley Van Dyke

87-29

Rebecca J. Balcom
Environmental Management Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

City of Medicine Hat
South Railway Street Realignment

PROJECT TYPE: HRIA

LOCATION/SETTING: The segment of South Railway Street which is of concern passes through the Medicine Hat railway yards in the downtown core of the city.

METHODOLOGY: The railway yards have undergone such disturbance that the possibility of buried prehistoric sites is remote; however, six structures were assessed by visual examination and archival research.

RESULTS: The six structures consist of a Roundhouse, the B and B Shop (Buildings and Bridges), the Regulator House, an M600 Garage, a Gas and Oil Storage House and a Sand House. The condition of the structures ranges from fair to poor with only the M600 Garage being in good condition. CP Rail had declared some of the structures to be unsafe and vacated them. The people of Medicine Hat viewed them as eyesores. It was recommended that the buildings be dismantled so that development could proceed.

SITE TYPES: Railway structures

DATES: The Roundhouse dates to about 1904, the B and B Shop to 1905, the Regulator House to 1905, and the other three structures to after 1947.

REPORT: Complete, entitled "Historical Resources Impact Assessment South Railway Street Alignment Medicine Hat Railway Yard, Final Report, Permit 87-29," by Rebecca J. Balcom

87-30

Eric Damkjar
7701 - 86 Avenue
Edmonton, Alberta

Texaco Canada Resources
Three Well Sites and
Access Roads

PROJECT TYPE: HRIA

LOCATION/SETTING: All three well sites are located near the communities of Spirit River and Rycroft in northwestern Alberta.

METHODOLOGY: Well sites and associated access roads were traversed on foot. Cultivated fields were surface inspected while other areas were shovel tested. Additional subsurface testing was conducted in the vicinity of archaeological sites. A total of 36 shovel tests were made; no deposits were screened.

RESULTS: Two sites were recorded. Fifty-seven historical and prehistoric cultural items were surface collected from GkQq-6, a large site covering two knolls near the Spirit River. A single large quartzite object was recovered from GkQq-7.

SITE TYPES: Prehistoric habitation/historical surface scatter and a prehistoric isolated find

CULTURAL AFFILIATION: A Besant projectile point was recovered from GkQq-6.

REPORT: Complete, entitled "Heritage Resources Impact Assessment of Three Texaco Canada Resources Proposed Well Sites and Access Roads, 14-8-78-5-W6M, 14-18-78-5-W6M, and 16-17-78-5-W6M, near Spirit River, Alberta," by Eric Damkjar

87-31

Eric Damkjar
7701 - 86 Avenue
Edmonton, Alberta

Texaco Canada Resources
Well Site and Access
Road

PROJECT TYPE: Mitigation

LOCATION/SETTING: Site GkQq-6 covers two knolls about 100 m from the Spirit River, near the towns of Rycroft and Spirit River in northwestern Alberta. Only the south knoll is to be affected by development.

METHODOLOGY: A 0.39 ha cultivated field situated on the south knoll was intensively and systematically surface collected. All finds were mapped.

RESULTS: Sixty-eight cultural items were recovered, including a projectile point, a biface, cores, flakes, hammerstones and faunal remains. An additional 37 items were recovered during and earlier HRIA (87-30).

CULTURAL AFFILIATION: Recovered projectile points appear to relate to the Besant Phase.

REPORT: Complete, entitled "Mitigation of GkQq-6, Texaco Canada Resources Well Site in 14-8-78-5-W6M, near Spirit River, Alberta," by Eric Damkjar

87-32

Rebecca J. Balcom
Environmental Management Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

Amoco Canada Petroleum Company Ltd.
Elk Point Project

PROJECT TYPE: HRIA

LOCATION/SETTING: The study area is located near the town of Elk Point, on both sides of the North Saskatchewan River. A total of 2.25 sections was inspected. Most of it is cultivated; the remainder is typical aspen parkland.

METHODOLOGY: Field techniques involved foot traverses, visual examination of exposures and shovel testing.

RESULTS: Thirteen prehistoric sites and two historical sites were recorded. It was recommended that development be allowed to proceed. The historical sites will be avoided.

SITE TYPES: Sites FlOr-5 to 8, 11 to 14 and 17 are lithic scatters; sites FlOr-9, 10 and 16 are isolated finds; site FlOr-15 is a buried workshop. The two historical sites are farmsteads.

REPORT: Complete, entitled "Historical Resources Impact Assessment Elk Point Project Final Report, Permit 87-32," by Rebecca J. Balcom

87-33

Rebecca J. Balcom
Environmental Management Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

Amoco Canada Petroleum Company Ltd.
Soars Lake Project

PROJECT TYPE: HRIA

LOCATION/SETTING: The project is located in east central Alberta, approximately 72 km south of Cold Lake. The impact assessment was conducted on moderate to high potential areas within 7.5 sections of land. The vegetation is typical of a boreal forest setting. Much of the terrain is wet and low lying.

METHODOLOGY: The area was examined by means of foot traverses, with inspection of exposures and shovel tests as appropriate.

RESULTS: No sites were located. It was recommended that development proceed.

REPORT: Complete, entitled "Historical Resources Impact Assessment Soars Lake Project Final Report, Permit 87-33," by Rebecca J. Balcom

87-34	**Glenn S.L. Stuart** **Fedirchuk McCullough & Associates Ltd.** **304, 1725 - 10 Avenue, S.W.** **Calgary, Alberta**	**Interprovincial Pipe Lines (NW) Limited** **Wells Site (FdOt-9)** **Anderson Site (FdOt-1)**

PROJECT TYPE: Mitigative excavations and surface collection

LOCATION/SETTING: The Wells site lies within a sand dune area near a small slough, approximately 1.75 km west of the Battle River in east central Alberta. The Anderson site is located approximately 0.65 km southwest of the Wells site in an area of parkland prairie.

METHODOLOGY: As a result of observations in the disturbed area of an existing pipeline right-of-way, combined with seven shovel tests in undisturbed areas of a proposed right-of-way, it was recommended that mitigative excavations be conducted. At the Wells site, 46 square metres were excavated, and disturbed portions of the site along the existing right-of-way were surface collected. In addition, a possible hearth at the Anderson site was excavated to ascertain is cultural significance.

RESULTS: The excavation of 4 square metres at the Anderson site resulted in the recovery of 12 artifacts and 57 bone fragments, the majority of which were from a disturbed context. The possible hearth turned out to be an extensive burn layer, likely associated with land clearing activities.

The excavation at the Wells site recovered 1020 artifacts, 1925 faunal remains (mostly small bone fragments) and 2477 pieces of FBR. The surface collection resulted in the recovery of an additional 53 artifacts, 82 faunal remains and 35 FBR fragments.

SITE TYPES: Wells site: multi-component campsite with evidence of extensive food processing activities which may have been associated with bison pounding in the area; Anderson site: stratified campsite

DATES: Analysis of the cultural material, radiocarbon dates, features and areal and vertical distribution of the cultural material at the Wells site suggests the initial occupation of the site consisted of a Samantha (Besant) campsite, dating to approximately A.D. 500. This component was followed by one or more Old Women's Phase occupations, ranging in dates from A.D. 700 to A.D. 800.

REPORT: Complete, entitled "Archaeological Investigations at the Wells Site and Anderson Site in Alberta's Parkland," by Fedirchuk McCullough and Associates Ltd.

87-35	Barry J. Dau Ethos Consultants Ltd. Group Box 20, Veinerville Medicine Hat, Alberta	Alberta Transportation/ Alberta Culture and Multiculturalism Upgrading of Dinosaur Trail (SR 838)

PROJECT TYPE: HRIA

LOCATION/SETTING: The project area is located along the Red Deer River, northwest of the city of Drumheller.

METHODOLOGY: The HRIA involved the examination of the uncultivated portions of the proposed upgrading right-of-way using foot traverse survey methods. In addition, a foot traverse survey was completed of a proposed gravel pit on the western rim of the Red Deer River valley.

RESULTS: Two previously unrecorded historical resource sites, EjPe-6 and EjPf-34, were identified within the boundaries of the development zones. EjPf-34 contains six poorly to moderately defined stone circles, and EjPe-6 contains a single well-defined stone circle. As relocation of the proposed developments appeared unlikely, recommendations were made to test excavate the sites prior to construction.

SITE TYPES: Stone circles

REPORT: Complete, entitled "An Historic Resources Impact Assessment of the Proposed Upgrading of Dinosaur Trail (SR 838) near Drumheller, Southern Alberta - ASA Permit 87-35," by Barry J. Dau

87-36	**Jack Brink** **Archaeological Survey of Alberta**	**Alberta Culture and Multiculturalism** **Head-Smashed-In Buffalo Jump**

PROJECT TYPE: Research

LOCATION/SETTING: The site is located in southwestern Alberta, on the eastern flank of the Porcupine Hills, about 16 km west of Fort Macleod.

METHODOLOGY: Research excavations were conducted in the processing site using 2 x 2 m units, with provenience recorded in arbitrary 10 cm levels. All identifiable bone, features, fire-broken rock and lithic remains were mapped in place. All excavated material was screened using 1/4 inch (6.3 mm) mesh. A sample of matrix from the excavation area - all dirt from a 1 x 1 m unit - was retained for fine screening.

RESULTS: A total of 8 square metres of the contiguous excavation was completed. The cultural deposits ranged in depth from near surface to 25 cm below the surface. Evidence of bison butchering and processing included hearths, boiling pits, hundreds of kilograms of fire-broken rock, and thousands of butchered bison bones.

SITE TYPE: Buffalo jump and associated camp and processing site

REPORT: In preparation

87-37	**Brian Ronaghan** **Archaeological Survey of Alberta**	**Alberta Culture and Multiculturalism** **First Albertans Project**

PROJECT TYPE: Research, inventory

LOCATION/SETTING: The project is located in the Kootenay Plains area of the Upper North Saskatchewan drainage east of Banff National Park. Specific locales selected for examination occurred in townships 35, 36, 37 and 38, ranges 15, 16, 17, 18 and 19, W5M.

METHODOLOGY: Prefield air photo interpretation, helicopter overflight, on ground visual examination, limited shovel testing and backhoe testing at two specific locales were conducted.

RESULTS: This survey was undertaken as part of the First Albertans research initiative by the A.S.A. Research Section. Based on topographic analogy to Early Prehistoric sites identified elsewhere in the Eastern Slopes, particularly Vermilion Lakes (EhPv-8; Fedje 1986) and Sibbald Creek (EgPr-2; Gryba 1983), specific landform types were selected for examination as potential early occupation locales. Visual examination of alluvial fans in the Lake Abraham area suggested that they are active and of relatively recent origin. Three small lithic scatter sites of unknown age were identified on high benches. Two locales exhibiting extensive deposition and buried surfaces were backhoe tested with negative results, but sampling of their sedimentary profiles provided excellent data which will aid definition of Holocene palaeoenvironments in this region.

REPORT: Incomplete, to be entitled "1987 First Albertans Research: The Upper North Saskatchewan Drainage," by Brian M. Ronaghan and Alwynne B. Beaudoin

87-38

Michael Forsman
Archaeological Survey of Alberta

Alberta Culture and Multiculturalism
Northeastern Alberta

PROJECT TYPE: Research

LOCATION/SETTING: Fort Chipewyan community, on north shore of Lake Athabasca

METHODOLOGY: The project included detailed site contour mapping, excavation with shovel and trowel, and screening of material. Investigations focussed on the 1872 Chief Factor's house; test excavations were carried out on 1872 store; 1985 excavations were continued.

RESULTS: Excavation of the Chief Factor's house was completed. The foundation was found to overlie earlier fort remains, some of which may date initial site occupation c. 1800. The store foundation was found badly disturbed, but also overlay earlier fort features.

SITE TYPE: Fur trade fort

DATE: c. 1800-1950s

REPORT: In preparation

87-39

Elizabeth Mann
Department of Anthropology
University of Alberta
Edmonton, Alberta

Alberta Culture and
Multiculturalism
Historic Dunvegan

PROJECT TYPE: Research and mitigative investigations around the still-standing Factor's house, Dunvegan

LOCATION/SETTING: Historic Dunvegan is located approximately 24 km south of the town of Fairview, in the Peace River valley. The site is landscaped.

METHODOLOGY: Units were excavated along the north, south and east sides of the house, including the southeast corner. Excavations were conducted by trowel and shovel shaving, and all matrix was screened with 1/4 inch mesh. All architectural remains were mapped and photographed.

RESULTS: Regularly spaced wooden joists were found along the south wall, including the southeast corner, and along the east wall. Wooden structural remains were found to the west and east of the north door and may represent part of a wooden walkway. The southeast corner building flagstone foundation was approximately 40 cm thick, as opposed to 1 m thick for the northwest corner (previously excavated).

SITE TYPE: Hudson's Bay Company fur trade fort

DATE: 1878-1918

REPORT: In preparation

87-42

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

Gulf Canada Corporation
Stettler Area Oil
Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline runs south of Stettler from the Pan Canadian Battery to Gulf Alberta Stettler Station. Terrain is rolling, and natural vegetation is aspen parkland, although much has been cultivated.

METHODOLOGY: Entire pipeline right-of-way, a distance of 35 km, was foot traversed, with shovel testing in areas of poor visibility and to determine site size.

RESULTS: Seven prehistoric sites were recorded.

SITE TYPES: Two temporary campsites (FbPc-2 and FbPd-4), four lithic scatters (FbPd-1 to 3 and 5), one isolated find (FbPc-1)

CULTURAL AFFILIATION: Old Women's Phase (FbPd-5)

REPORT: Complete, entitled "Historical Resources Impact Assessment, Stettler Area Oil Pipeline," by Bea Loveseth

87-43

Rebecca J. Balcom
Environmental Management Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

Norcen Energy Resources
Hilda Lake Pilot Project

PROJECT TYPE: Historical resources reconnaissance and impact assessment

LOCATION/SETTING: The study area occupies one quarter section located about 17.5 km northwest of Cold Lake. The area is just north of Hilda Lake; terrain is gently undulating with typical boreal forest vegetation.

METHODOLOGY: Field techniques consisted of foot traverses, visual examination of exposures and shovel testing.

RESULTS: One small, buried prehistoric site (GdOo-29) and one historical site were located inside the study area. Two historical sites were recorded outside the study area. All sites will be avoided by Norcen, and it was recommended that development proceed.

SITE TYPES: Small, buried find, historical farmsteads and sawmill

REPORT: Complete, entitled "Historical Resources Impact Assessment Norcen Energy Resources Hilda Lake Pilot Project Permit 87-43," by Rebecca J. Balcom

87-44

Glenn S.L. Stuart
Fedirchuk McCullough & Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

Korite Limited
Ammolite Mine

PROJECT TYPE: Mitigation

LOCATION/SETTING: Site DjPf-113, containing two stone circles and an oval stone feature, is situated on a high ridge and adjacent terrace on the south bank of St. Mary River. Only the oval feature situated on the high ridge will be impacted by mine development.

METHODOLOGY: The site area was mapped; individual feature maps of the two stone circles were completed. A map of both the surficial and subsurface rock constituents of the oval stone feature was made using the grid established for excavation. Sixteen square metres were excavated at the oval stone feature.

RESULTS: Nineteen artifacts were recovered from the excavation, including a Baculites fossil. After excavation, it was confirmed that the structure, constructed of approximately 90 rocks, is roughly oval in outline with a east southeast/west northwest orientation. Estimated inside diameter is 125 x 60 cm, and the outside diameter is 275 x 180 cm. Based on the associated artifact assemblage, general configuration, size, orientation, isolated located on a ridge, and presence of the Baculites fossils in comparison to known vision quest structures and ethnographic descriptions, the oval feature is interpreted as a vision quest.

SITE TYPE: Stone feature: vision quest structure and associated stone circles

REPORT: Complete, entitled "DjPf-113 A Vision Quest Site in South Central Alberta," by Glenn S.L. Stuart

87-45

Rebecca J. Balcom
Environmental Management Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

Westmin Resources Ltd.
Sieu Lake Area Pipelines

PROJECT TYPE: HRIA and monitoring

LOCATION/SETTING: The pipelines are in the undulating terrain of the Wintering Hills area, south of the Red Deer River. The vegetation is typical native short grass prairie. The two pipelines total approximately 12 km.

METHODOLOGY: Field techniques involved foot traverses, visual inspection of exposures and shovel testing. Some sites in close proximity to the development were monitored during the ditching.

RESULTS: Nine prehistoric sites were recorded (EgPc-4, EhPc-120 to 126 and EhPd-68). Development has proceeded without impacting the sites.

SITE TYPES: The sites consist of lithic scatters, a campsite, cairns and tipi rings.

REPORT: In preparation

87-46

Brian O.K. Reeves
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

H. Ash and Associates Ltd.
Residential Subdivision

PROJECT TYPE: HRIA

LOCATION/SETTING: The subdivision is located in the town of Cochrane, north of the Bow River and west of Big Hill Creek. It is situated on river terrace remnants covered by grasses and low bushes and poplar along the river and creek banks.

METHODOLOGY: Surface exposures and features were examined, and 12 backhoe tests were excavated.

RESULTS: Two prehistoric sites (EhPo-70 and 71) and one historical site (part of EhPo-71) were found.

SITE TYPES: Tipi ring (EhPo-70), subsurface kill site and historical cabin foundation (EhPo-71)

REPORT: Complete, entitled "Historical Resources Impact Assessment, Residential Subdivision, Part of NW 34-25-4-5," by Brian O.K. Reeves

87-47

Brian O.K. Reeves
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

P. Shimbashi Management and Consulting Ltd.
Residential Subdivision

PROJECT TYPE: HRIA

LOCATION/SETTING: The subdivision is located on the west side of the Oldman River in the city of Lethbridge. The terrain is prairie escarpment and river terraces dissected by coulees and has been largely disturbed by cultivation.

METHODOLOGY: Foot traverses were structured according to landforms and their historical resource potential.

RESULTS: Two historical resource sites were recorded.

SITE TYPES: Tipi rings (DkPf-109); surface camp (DkPf-110)

REPORT: Complete, entitled "Historical Resources Impact Assessment Riverbend Estates, City of Lethbridge," by Brian O.K. Reeves

87-48	**Glenn S.L. Stuart Fedirchuk McCullough & Associates Ltd. 304, 1725 - 10 Avenue, S.W. Calgary, Alberta**	**Bow River Pipe Lines Ltd. Pipeline Project**

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed pipeline is situated southeast of Calgary and crosses the Little Bow River. The project lies within the mixed prairie region of southern Alberta.

METHODOLOGY: Examination of fortuitous exposures and excavation of shovel tests were used to identify the presence of historical resource materials.

RESULTS: Three prehistoric sites (EcPa-9 and EcPb-34 and 35) and one historical site (EcPb-36) were recorded.

SITE TYPES: Isolated find (EcPb-35), campsite (EcPa-9), stone feature - three complete stone circles, one partial stone circle, two rock alignments and artifact scatter (EcPb-34) and farmstead (EcPb-36)

REPORT: Complete, entitled "Historical Resources Impact Assessment Bow River Pipe Lines Ltd. Little Bow Lateral," by Glenn S.L. Stuart

87-49	**John H. Brumley Ethos Consultants Ltd. Group Box 20, Veinerville Medicine Hat, Alberta**	**Dynex Petroleum Two Proposed Gas Well Sites North of Medicine Hat**

PROJECT TYPE: HRIA

LOCATION/SETTING: The two proposed well sites are located within 500 m of one another in the valley of the South Saskatchewan River. Both are on the upper "neck" area on a point of land formed by a sharp river meander. The prairie surface is essentially level to slightly undulating and slopes gently downwards to the west.

METHODOLOGY: Examination involved a series of traverses across the surface of both well sites and their surrounding margins. Individual traverses were spaced at no greater than 5 m intervals. A similar examination was carried out along the single proposed access road to the point where it joined the existing trail.

RESULTS: Examination of the two proposed well sites failed to reveal any historical resource materials. As a result, no further action is considered necessary.

REPORT: Complete, entitled "An Historic Resource Impact Assessment of Two Proposed Gas Wellsites North of Medicine Hat, Alberta A.S.A. Permit 87-49," by John H. Brumley

87-50

Eugene M. Gryba
3, 346 - 4th Avenue, N.E.
Calgary, Alberta

Kimm Holdings Ltd.
Lac Ste. Anne
Settlement

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed subdivision is located on the west side of Lac Ste. Anne just north of Alberta Beach, in central Alberta. Development property is removed from current lake edge about 300 m. Rolling terrain, with local knolls rising to less than 10 m above surrounding land, reflects ablation morrain. Glacial till occurred at the surface. Area is heavily forested with mature aspen and balsam poplar.

METHODOLOGY: Foot traverse and visual inspection of the 20 ha project area was undertaken. Extensive shovel testing was also carried out, particularly along the summit of local knolls.

RESULTS: No evidence of prehistoric sites was found during the survey. An abandoned building, roads and cleared building sites relate to relatively recent development of the area.

REPORT: Complete, entitled "Historical Resources Impact Assessment of Lot 21, Lac Ste. Anne Settlement for Kimm Holdings, Ltd.," by Eugene M. Gryba

87-51

Barry J. Dau
Ethos Consultants Ltd.
Group Box 20, Veinerville
Medicine Hat, Alberta

Dome Petroleum Ltd.
Buffalo Exploratory
Oil Well Site

PROJECT TYPE: HRIA

LOCATION/SETTING: The project area is situated immediately south of SR 555, approximately 4500 m west of the village of Buffalo.

METHODOLOGY: The HRIA consisted of a foot traverse survey of a proposed oil well site and its associated access road.

RESULTS: A single, previously unrecorded historical resource site, EeOq-70, was identified during the HRIA. The site contains seven moderately to well-defined stone circles, two of which are within the boundaries of the proposed well site. Recommendations were made to relocate the well site in order to avoid all features in site EeOq-70.

SITE TYPE: Stone circles

REPORT: Complete, entitled "An Historic Resources Impact Assessment of a Proposed Oil Wellsite near Buffalo, Southeastern Alberta - A.S.A. Permit 87-51," by Barry J. Dau

87-52

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

Suncor Inc. Resources Group
Gas Pipelines

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipelines are located south of Orion and southeast of Manyberries. Terrain is flat for the former and gently rolling for the latter. Both areas are covered by short grass prairie.

METHODOLOGY: Systematic foot traverses were conducted along approximately 2.9 km of 15 m wide right-of-way.

RESULTS: No sites were found.

REPORT: Complete, entitled "Historical Resources Impact Assessment, Suncor Gas Pipelines in the Manyberries Area," by Bea Loveseth

87-53

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

Canadian Montana Gas Company Ltd.
Pakowki Lake Gas Gathering Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline is situated on east side of Pakowki Lake in the Manyberries area. Terrain is flat to gently rolling, covered with prairie grasslands. Numerous historical irrigation ditches are present, as are two creeks. About 17 percent of the land is cultivated.

METHODOLOGY: Foot traverses were done on 9.6 km of 15 m wide right-of-way, with shovel testing in areas of poor visibility.

RESULTS: No sites were located.

REPORT: Complete, entitled "Historical Resources Impact Assessment, Pakowki Lake Gas Gathering Pipeline," by Bea Loveseth

87-54

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

Shell Canada Limited
Manyberries Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The project area is north and east of Manyberries on badlands and gently rolling open prairie terrain in the vicinity of Manyberries Creek. Vegetation is mainly short grass with small, cultivated areas.

METHODOLOGY: Foot traverses were done on 12 km of 15 m wide rights-of-way, with judgementally placed shovel tests.

RESULTS: Five prehistoric sites were recorded.

SITE TYPES: One temporary campsite (DiOp-46), three lithic scatters (DiOp-44, 45 and 48) and one isolated find (DiOp-47)

REPORT: Complete, entitled "Historical Resources Impact Assessment, Manyberries Pipeline Project," by Bea Loveseth

87-55

J. Rod Vickers
Archaeological Survey of Alberta

Alberta Culture and Multiculturalism
Fletcher Site Research

PROJECT TYPE: Research excavation

LOCATION/SETTING: Prairie level on the north side of Chin Coulee in southern Alberta

METHODOLOGY: One 2 x 2 m unit was excavated on the southern edge of a dugout at approximately the highest point. Excavation was by shovel shaving in 10 cm arbitrary and natural levels to 2 m below surface; all matrix was sieved through 0.63 cm mesh screens. Excavation was by trowel and fine tools in the Cody horizon (2-2.5 m below surface); matrix was retained and water-screened through 0.63 cm sieves in the lab. Matrix samples (two 1 litre samples/matrix bag) were retained. Fine screening of selected samples was contracted (Steinhauser 1988). Neutron Activation Analysis of bone and soil samples was conducted (Gray 1987). Palaeomagnetic samples (Barendregt) and pollen samples (Beaudoin) were extracted but are not yet analysed or reported.

RESULTS: Excavation of the Cody horizon was incomplete in 1987 and continued in 1988. Analysis of material is ongoing.

SITE TYPE: Buried camp/kill

REPORT: Reporting obligations for permit 87-55 will be incorporated with those for permit 88-29.

87-56

James A. Light
Historical Resource Management
910, 1335 - 12 Avenue, S.W.
Calgary, Alberta

BHP Petroleum (Canada) Inc.
Pipeline

PROJECT TYPE: HRIA of a proposed pipeline route and monitoring at DlPc-13

LOCATION/SETTING: The proposed development is located in an area of native prairie on the north side of the Oldman River near the town of Taber. The proposed route travels from prairie level down the valley wall to connect with a well site on the floodplain.

METHODOLOGY: The route was selected by the archaeologist in conjunction with the land surveyors while in the field. After an acceptable route was selected, the entire right-of-way was walked. Shovel testing was done in areas of high and medium potential for buried historical resource sites. The site which was found was recorded, mapped and photographed. Monitoring of the pipeline construction was done where it crossed the site.

RESULTS: One site, DlPc-13, was recorded during the present work. The site comprises 22 surface features, mostly stone circles with some arcs. A sparse lithic scatter was also noted. A grooved maul was collected from the ring rocks of Feature 4. The monitoring revealed a buried component of unknown depth. Artifacts recovered during monitoring included several quartzite flakes and some bone fragments.

SITE TYPE: Prehistoric campsite

REPORT: Complete, entitled "Historical Resources Impact Assessment and Monitoring of BHP Petroleum (Canada) Inc.'s Pipeline in S29 and S32-T10-R18-W4M Final Report Permit 87-56," by James A. Light

87-57

Glenn S.L. Stuart
Fedirchuk McCullough &
Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

NOVA Corporation
of Alberta
Ghostpine Lateral
Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed pipeline project is situated northwest of Drumheller and crosses the Red Deer River. The project lies within the grassland region of south central Alberta.

METHODOLOGY: Examination of ploughed surfaces, borrow pit exposures, previous pipeline disturbance, and other natural fortuitous exposures and excavation of shovel tests were used to identify the presence of prehistoric cultural materials.

RESULTS: Five prehistoric sites were recorded during the archaeological reconnaissance, and three palaeontological sites were recorded during the palaeontological reconnaissance (L. V. Hills).

SITE TYPES: Artifact scatters - buried (EjPf-39) and surface (EjPf-37), campsites (EjPf-36, 38 and 40) and palaeontological remains - dinosaurian remains

(Localities 1 and 3) and dinosaurian and plant remains (Locality 2)

DATES: Middle to Late Prehistoric based on recovery of the body of a side-notched projectile point from Shovel Test 1

REPORT: Complete, entitled "Historical Resources Impact Assessment Nova, An Alberta Corporation Ghostpine Lateral Loop," by Glenn S.L. Stuart and L.V. Hills

87-58

Rebecca J. Balcom
Environmental Management Associates
1510 - 10th Avenue, S.W.
Calgary, Alberta

Murphy Oil Co. Ltd.
Lindbergh Phase II

PROJECT TYPE: HRIA

LOCATION/SETTING: This phase encompasses 22 sections northeast of Elk Point. The terrain is flat to undulating with some minor water courses and terracing. Vegetation is typical boreal forest with some cultivated lands.

METHODOLOGY: Medium and high potential segments of the sections were examined. Field techniques involved closely spaced foot traverses, visual inspection of exposures and shovel testing. All historical sites were recorded.

RESULTS: Eight prehistoric and eight historical sites were found (FlOp-13 to 15, FlOq-5 to 9 and GaOq-1).

SITE TYPES: Isolated finds, small finds, lithic scatters, campsites, historical farmsteads and a dugout home

DATES: One site (FlOq-7) is Duncan which dates to ca. 4,500 years B.P.

REPORT: Complete, entitled "Historical Resources Impact Assessment Murphy Lindbergh Phase II Final Report, Permit 87-58," by Rebecca J. Balcom

87-59C

Glenn S.L. Stuart
Fedirchuk McCullough & Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

Alberta Culture and Multiculturalism/
Alberta Transportation
Cranford Site

PROJECT TYPE: Mitigation

LOCATION/SETTING: DlPb-2 is situated in the grasslands of southern Alberta, approximately 9 km north of the hamlet of Cranford. The site lies on a high terrace overlooking the Oldman River to the north. It has been divided into three sections: east, west and central. The 1987 project dealt only with the central section which contains 40 stone circles. Fourteen of these had been mapped and tested previously (see Balcom 1987).

METHODOLOGY: Twenty-six stone circles were mapped and then excavated. Each stone circle was tested by excavating centrally located 2 x 2 m units. The results of this testing program, combined with the results of Balcom's (1987) tests, were used to determine which rings warranted further investigation. A total of 224 square metres were excavated. The units ranged in depth from 10 to 45 cm below surface.

Technological and raw material analyses are being undertaken on the lithic remains to ascertain variations in technology and the types of materials used both from ring to ring and through time. Vertical and horizontal distributional studies, plus conjoinability and provenience studies, are also being undertaken to determine if vertical and lateral distinctions in the artifact assemblages can be made. The recorded weight of the individual ring rocks and the relative distribution of weight of the ring rocks in each of the stone circles will be analysed and compared to determine whether all of the stone circles excavated were occupied during the same season. Formal (architectural) variability of the stone circles will be compared to isolate significant similarities or differences which may reflect 'clustering' of specific stone circles, as well as isolating associations with local terrain or temporal affiliation. Radiocarbon analysis of charcoal and bone is being undertaken to more precisely date times of occupation. Bone collagen and palynological analyses will provide palaeoenvironmental data and serve as a aid in determining temporal affiliations.

RESULTS: Of the total 22 projectile points recovered from the site, eight have been tentatively identified as McKean, three as Pelican Lake, three as Besant, one as Avonlea, two as Late Plains side-notched (Old Women's), one as a possible Salmon River, and one as a possible Oxbow variant. The remaining projectile points are unidentifiable fragments.

DATES: Absolute dates are as yet unavailable. Accepting the above typological identifications, the site could reflect occupations from ca. 5,000 years B.P. to ca. 250 years B.P.

REPORT: Incomplete, to be entitled "The Cranford Site," by Glenn S.L. Stuart

87-60C

Thomas Head
Bison Historical Services
236 - 11A Street, N.W.
Calgary, Alberta

Alberta Transportation
Borrow Pit and Highways
Mitigation of Impacts

PROJECT TYPE: Mitigation of impacts to prehistoric sites EjPe-6, EjPf-14 and EfPf-34

LOCATION/SETTING: EjPe-6 is located on the west boundary of widened right-of-way of Dinosaur Trail (SR 838) north of Drumheller. EjPf-14 and 34 are located in a borrow pit north and west of the Bleriot Ferry. The former lies in grassland on the valley bottom of the Red Deer River. The latter is located on a high prairie edge of the river.

METHODOLOGY: Eight square metres on one stone circle were excavated at EjPe-6; 14 square metres were excavated on six stone circles at EjPf-34; 4 square metres were excavated on 4 of 36 stone circles at EjPf-14. Horizontal provenience was 50 cm, and vertical provenience was 10 cm. Detailed maps of sites were also produced.

RESULTS: EjPe-6 produced 31 artifacts, consisting of debitage and a single biface, and a faunal assemblage, consisting of six identifiable elements (bison, MNI=2) and 43 unidentified fragments. EjPf-34 yielded 56 lithic artifacts. Diagnostic or other formed tools were absent. EjPf-14 yielded 28 lithic artifacts and evidence of a charcoal-filled hearth. No diagnostic or other formed tools were recovered. Faunal materials at EjPf-14 and 34 were minor and uninterpretable.

SITE TYPES: Stone circle sites

REPORT: Complete, entitled "Final Report, Historical Resources Mitigation, SR 838, Prehistoric Sites EjPe-6, EjPf-14 and EjPf-34. ASA Project Number 87-60-C," by Thomas Head

87-61

Edward J. McCullough
Fedirchuk McCullough &
Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

Federated Pipe Lines
Ltd.
Pipeline Project

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed pipeline project is situated immediately west and southwest of Edmonton, along the eastern edge of the parkland region of western Alberta.

METHODOLOGY: An HRIA was required only of areas of high and medium potential. All fortuitous exposures, including ploughed surfaces, were examined. Excavation of shovel tests in areas of limited visibility was used to identify the presence of prehistoric cultural materials.

RESULTS: Nine prehistoric sites were recorded.

SITE TYPES: Isolated finds (FhPl-8, FiPl-15, 17 and 18), campsites (FhPl-9 and FiPl-12 to 14 and 16)

DATES: No culturally or temporally diagnostic material was recovered during the HRIA; however, a land owner had collected a wide range of projectile points indicative of Early to Late Middle Prehistoric age to the west of the development zone at site FiPl-16.

REPORT: Complete, entitled "Historical Resources Impact Assessment Federated Pipe Lines Ltd. Bonnie Glen-Acheson N.G.L. Pipeline Project," by Fedirchuk McCullough and Associates

87-62

Eric Damkjar
7701 - 86 Avenue
Edmonton, Alberta

Texaco Canada Resources
Well Site and Access
Road

PROJECT TYPE: HRIA

LOCATION/SETTING: The well site is situated on the southwest edge of a large hill, 2 km north of Carlos and 30 km northwest of Rocky Mountain House.

METHODOLOGY: The 1.4 ha well site was systematically assessed with 53 evenly spaced test pits. The 1 km access road was surface inspected along exposed portions, and the subsurface was tested elsewhere (15 test pits). None of the sediment was screened.

RESULTS: The remains of a historical building and associated refuse were found on the south part of the access road.

SITE TYPES: Historical

DATES: Historical remains likely dated to the early 1930s when the land was homesteaded.

REPORT: Complete, entitled "Heritage Resources Impact Assessment of a Texaco Canada Resources Proposed Well Site and Access Road, Texaco Gilby 14-34-41-5-W5M," by Eric Damkjar

87-63

Eric Damkjar
7701 - 86 Avenue
Edmonton, Alberta

Alberta Municipal Affairs
Cotillion Recreation Area

PROJECT TYPE: Mitigation

LOCATION/SETTING: HaQw-3 is situated on the south shore of the Peace River, at Sneddon Creek, approximately 18 km east of the Alberta-British Columbia border and 70 km northwest of Spirit River.

METHODOLOGY: A total of 8.81 square metres of intact deposits situated between the Peace River and an existing road-cut were excavated. Approximately 10 percent of the deposit was water-screened through 3.2 mm mesh, while the remainder was dry-screened through 6.1 mm mesh. In addition, disturbed deposits associated with the road-cut were screened to recover artifacts.

RESULTS: In all, 6,886 cultural items were recovered, including projectile points, bifaces, scrapers, bipolar cores and hammerstones. Lithic debitage and small bone fragments account for almost 98 percent of items recovered.

SITE TYPE: Habitation/lithic workshop

DATE: Side-notched projectile points suggest a Late Prehistoric age.

REPORT: Complete, entitled "Mitigation of HaQw-3, Cotillion Recreation Area, Upper Peace River, Alberta," by Eric Damkjar

87-64

Richard Callaghan
ARESCO Ltd.
P.O. Box 1174
Postal Station G
Calgary, Alberta

Esso Resources Canada Ltd.
Olds Well Site

PROJECT TYPE: HRIA

LOCATION/SETTING: The project is located in the Olds area, south and west of the Red Deer River. The well site was at the head of a tributary of Lonepine Creek. The study area had been cleared of trees and cultivated.

METHODOLOGY: Foot traverses and subsurface testing were conducted as necessary.

RESULTS: No sites were located.

REPORT: Complete, entitled "Historical Resources Impact Assessment Well Site and Access Road near Olds, Alberta LSD 14/32/33/28/W4M Final Report, Permit 87-64," by Richard Callaghan and Colin Poole

87-65

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

NOVA Corporation of Alberta
Kathleen Sales Lateral Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline is located south of McLennan and west Winagami Lake. Terrain is flat with aspen/poplar parkland interspersed with muskeg harboring white and black spruce. About 60 percent of the study area has been cultivated.

METHODOLOGY: Foot traverses of 7.0 km and spot checks of 3.1 km of the 15 m wide pipeline right-of-way were undertaken.

RESULTS: No sites were located.

REPORT: Complete, entitled "Historical Resources Impact Assessment, Kathleen Sales Lateral Pipeline," by Bea Loveseth

87-66

Heinz Pyszczyk
Archaeological Survey of Alberta

Alberta Culture and Multiculturalism
Fort Vermilion Archaeological Survey

PROJECT TYPE: Research, inventory

LOCATION/SETTING: The project encompasses lands adjacent to the Boyer River, west of Highway 67 to the Peace River, ending on the south edge of Township 105, south of La Crete.

METHODOLOGY: Foot traverse, site recording and mapping were conducted. Diagnostic artifacts were collected from sites. Two historical (fur trade) sites were shovel tested and mapped.

RESULTS: A total of 25 quarter sections of cultivated land were surface surveyed in the study area. Also, some wooded sections along the Peace River, south of the Boyer River were surveyed. Approximately 33 prehistoric and historic sites were recorded, and a number of private collections were examined. A series of projectile points, representing the Middle to Late Prehistoric period were recovered; other stone artifacts were also recovered from a number of sites. One new, early fur trade fort was identified in the region.

SITE TYPES: Prehistoric/historical habitation sites, fur trade forts, Metis sites

REPORT: In preparation

87-67	Eugene M. Gryba 3, 346 - 4th Avenue, N.E. Calgary, Alberta	Alberta Transportation SR 532 and SR 533

PROJECT TYPE: HRIA of approximately 10 km of highway upgrading

LOCATION/SETTING: Projects were located along SR 532 and SR 533 west of Nanton. SR 532 is located in the Rocky Mountain eastern slopes, while SR 533 crosses the north end of the Porcupine Hills. The environment is largely foothills terrain. Vegetation ranges from aspen and spruce forest of patches of open prairie

METHODOLOGY: Foot traverse and visual inspection were undertaken. Extensive shovel testing was carried out along SR 532, especially where proposed curve revisions crossed archaeologically promising terrain overlooking Stimson Creek valley. Two small, previously reported sites, EbPn-4 and 5, were reassessed even though they occurred outside the proposed impact zone. Undisturbed sandstone cliffs along SR 533 were examined for pictographs and petroglyphs, while recent bedrock exposures were checked for palaeontological remains.

RESULTS: One small rock cairn (EbPo-5) of undetermined age was discovered on a small grassy knoll near the edge of Stimson Creek. The feature is situated just outside the proposed alignment boundary. No additional material was discovered at either EbPn-4 or 5.

REPORT: Complete, entitled "Historical Resources Impact Assessment of Secondary Roads 532 and 533 in Southwestern Alberta," by Eugene M. Gryba

87-68

James A. Light
Historical Resource
Management
910, 1335 - 12 Avenue, S.W.
Calgary, Alberta

Northstar Energy
Corporation
Pipeline Project

PROJECT TYPE: HRIA and monitoring

LOCATION/SETTING: Pipeline is located near the town of Taber and crosses the Oldman River in an area of natural prairie.

METHODOLOGY: The right-of-way was walked and shovel tested in areas of medium to high potential for buried archaeological resources. Since the route passed in close proximity to the Cranford site (DlPb-2), that area was also shovel tested. Results there revealed a possibility of deeply buried material, and that portion of the trench was monitored during excavation.

RESULTS: One new site (DlPb-13) was defined, and the northeastern edge of the Cranford site (DlPb-2) was found to contain deeply buried deposits. DlPb-13 had been included as part of DlPb-2 on some site forms but was separated because it sits on a separate landform. It consists of at least 28 rings and ten cairns. The deeply buried material at DlPb-2 was found at 1 m to 1.2 m below surface. It consisted of buried ring rocks and fire-broken rock. One large core was collected.

REPORT: Complete, entitled "Historical Resources Impact Assessment of Northstar Energy Corporation's Pipeline in Township 10 Ranges 17 and 18 W4M Final Report Permit 87-68," by James A. Light

87-69

Edward J. McCullough
Fedirchuk McCullough &
Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

TransAlta Utilities
Corporation
Transmission Line

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed portion of the pipeline project requiring investigation under this permit crosses the Bow River. The project lies within the mixed prairie region of south central Alberta.

METHODOLOGY: The landowner had reported the presence of a stone circle within the Bow River crossing development area. The area where the feature had been reported and the other side of the proposed crossing were examined visually for surficial features. Shovel tests were excavated in the area of the identified feature to determine whether buried prehistoric cultural materials were present.

RESULTS: One prehistoric site (EbOx-3) was recorded.

SITE TYPE: Stone circle

REPORT: Complete, entitled "Historical Resources Impact Assessment TransAlta Utilities Corporation Bow River Crossing, Brooks - Hays 421S 138kV Transmission Line, 795L," by Edward J. McCullough

87-70

Glenn S.L. Stuart
Fedirchuk McCullough &
Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

Singleton Associated
Engineering
EcPa-9: The Wheeler
Site

PROJECT TYPE: Surface collection

LOCATION/SETTING: The Wheeler site is located on the east bank of the Bow River in south central Alberta. It covers an area of approximately 50,000 square metres of a ploughed field.

METHODOLOGY: Only a relatively small portion of the site was surface collected, including the area within a proposed pipeline right-of-way and an area on a portion of the terrace where disturbance by ploughing was minimal. Artifact provenience was recorded by 50 x 50 cm quarter-units for the first 150 units and then by 1 x 1 m units as we moved further away from the less disturbed area and as artifact numbers declined.

RESULTS: Four bone fragments, 377 lithic artifacts and 350 pieces of FBR were recovered. The assemblage is consistent with excavated tipi ring sites.

SITE TYPE: Campsite/tipi ring

DATE: Attributed to the Late Prehistoric Period (ca. A.D. 1000-A.D. 1800, on the basis of the morphology of a recovered projectile point midsection.

REPORT: Complete, entitled "Results of a Surface Collection Program Conducted at EcPa-9: The Wheeler Site South Central Alberta," by Fedirchuk McCullough and Associates Limited

87-71

Edward J. McCullough
Fedirchuk McCullough &
Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

PanCanadian Petroleum
Limited
Heavy Oil Development

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed heavy oil development area is situated on Frog Creek, east of Elk Point, within the boreal forest of eastern Alberta.

METHODOLOGY: Examination of fortuitous exposures and excavation of shovel tests were used to identify the presence of prehistoric cultural materials. Emphasis was placed on physiographic features found to be associated with recorded prehistoric sites in the area.

RESULTS: No prehistoric sites were recorded.

REPORT: Complete, entitled "Historical Resources Impact Assessment PanCanadian Petroleum Limited Lindbergh Heavy Oil Project Section 7, Township 56, Range 3, W4M," by Edward J. McCullough

87-72

Glenn S.L. Stuart
Fedirchuk McCullough &
Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

Wedgewood Developments
Bear River Subdivision

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed subdivision project is situated on Bear River south of Grande Prairie.

METHODOLOGY: Examination of disturbances and excavation of shovel tests were used to identify the presence of prehistoric cultural materials.

RESULTS: No sites were recorded.

REPORT: Complete, entitled "Historical Resources Impact Assessment Wedgewood Developments Bear River Subdivision," by Glenn S.L. Stuart

87-73

James A. Light
Historical Resource Management
910, 1335 - 12 Avenue, S.W.
Calgary, Alberta

NOVA Corporation of Alberta
Berry Creek South Lateral Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The pipeline is located near Pollockville, in an area of gently rolling short grass prairie.

METHODOLOGY: The entire right-of-way was walked and shovel tested in areas of medium to high potential for buried archaeological material.

RESULTS: Five sites were identified (EhOu-1, 2, 3 and EhOv-2 and 3).

SITE TYPES: Isolated finds, cairn, historical cellar pits

DATES: The historical sites date to about 1908.

REPORT: Complete, entitled "An Historic Resources Impact Assessment of Nova's Berry Creek South Lateral Final Report Permit 87-73," by James A. Light

87-74

Edward J. McCullough
Fedirchuk McCullough & Associates Ltd.
304, 1725 - 10 Avenue, S.W.
Calgary, Alberta

Federated Pipe Lines Ltd.
Strachan Lateral Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed pipeline is situated southwest of Edmonton, on the eastern edge of the mixed wood boreal forest of western Alberta.

METHODOLOGY: The Archaeological Survey of Alberta identified 26 localities along the proposed route for an HRIA. All fortuitous exposures provided by ploughed surfaces, wind- and water-eroded surfaces, as well as disturbances associated with construction of Highway 22, well sites and railway lines were examined. Shovel tests were excavated in areas of limited exposure.

RESULTS: Five prehistoric sites (FcPr-18 and 19, FdPr-2 and 3 and FePr-1) were recorded.

SITE TYPES: Isolated finds

REPORT: Complete, entitled "Historical Resources Impact Assessment Federated Pipe Lines Ltd. Strachan Lateral Pipeline Project," by Edward J. McCullough

87-75

Thomas Head
Bison Historical Services
236 - 11A Street, N.W.
Calgary, Alberta

Shell Canada Limited
Clearwater and Panther
River Pipeline Projects

PROJECT TYPE: HRIA

LOCATION/SETTING: Projects involved selected crossings of major and tributary rivers and various other segments in the forested foothills astride the Forestry Trunk Road in the vicinity of the Panther and Clearwater rivers where they intersect the road. The selected traverses involve 42 km of right-of-way, an area of approximately 64 ha.

METHODOLOGY: Comprehensive traverses of right-of-way were conducted, with systematic and judgemental shovel testing in areas of moderate and high archaeological potential.

RESULTS: Two historical (Tay River Cabin and Cutoff Creek Cabin) and three prehistoric sites (ElPu-1 and 14 and FaPt-3) were identified on the Clearwater development project right-of-way. Two prehistoric sites (EjPt-4 and EjPu-1) were identified on the Panther River development pipeline right-of-way. EjPt-4, EjPu-1 and ElPu-1, all productive prehistoric sites, were recommended for further work.

SITE TYPES: Campsites (ElPu-14 and EjPu-1), lithic scatters (ElPu-1 and EjPt-4) and a buried isolated find (FaPt-3)

REPORT: Complete, entitled "Final Report, Historical Resources Impact Assessment, Clearwater Development Project and Panther River Development Pipeline, ASA Project Number 87-75," by Thomas Head

87-76C	James A. Light Historical Resource Management 910, 1335 - 12 Avenue, S.W. Calgary, Alberta	Alberta Culture and Multiculturalism Historical Cemetery

PROJECT TYPE: HRIA of portions of a cemetery which will be affected by the widening of Highway 16

LOCATION/SETTING: This work was located at a small, unregistered cemetery near the town of Marlboro which is between Edson and Hinton.

METHODOLOGY: The work was divided into two segments: (1) to determine the number and locations of the unmarked burials and (2) to implement a plan to disinter the burials and reinter them in the Marlboro cemetery. The first segment entailed digging trenches by hand across each of the possible burials to determine the extent of the original grave excavation. The second phase called for pedestaling the burials and crating them for removal.

RESULTS: In all, 12 trenches (approximately 27 cubic metres) were excavated, but no burials were encountered in the area slated for highway development. As a result, the second phase of the project was not needed.

SITE TYPE: Historical cemetery

REPORT: Complete, entitled "Historical Resource Impact Assessment of an Unmarked Historic Period Cemetery near the Town of Marlboro, Final Report Permit 87-76C," by James A. Light

87-77	Barry J. Dau Ethos Consultants Ltd. Group Box 20, Veinerville Medicine Hat, Alberta	Kneehill Energy Ltd. Neutral Hills to Throne Pipeline

PROJECT TYPE: HRIA

LOCATION/SETTING: The project area runs west-southwest from the base of the Neutral Hills to Highway 12 near the town of Coronation.

METHODOLOGY: The HRIA involved a foot traverse survey of the entire 33.8 km long pipeline right-of-way. Both cultivated and uncultivated sections of the 15 metre wide line were examined in detail.

RESULTS: Two previously unrecorded historical resource sites, FaOr-9 and FaOs-1, were identified during the HRIA. Both are situated in heavily rolling, uncultivated terrain immediately south of the Neutral Hills. FaOr-9 contains three well-defined stone circles, one of which is within the proposed right-of-way. FaOs-1 contains two well-defined stone circles, both of which are within the proposed right-of-way. Recommendations were made to relocate the proposed right-of-way to avoid the noted sites.

SITE TYPES: Stone circles

REPORT: Complete, entitled "An Historic Resources Impact Assessment of a Proposed Oil Pipeline near Coronation, Alberta - A.S.A. Permit 87-77," by Barry J. Dau

87-78

Richard Callaghan
ARESCO Ltd.
P.O. Box 1174
Postal Station G
Calgary, Alberta

Genstar Development Company
Calgary Subdivision

PROJECT TYPE: HRIA

LOCATION/SETTING: The subdivision is located south Calgary, south of Fish Creek and west of the Bow River. It consists of 166.2 acres of cleared and cultivated land.

METHODOLOGY: Foot traverses and subsurface testing by shovel and back-hoe as necessary

RESULTS: Eleven sites (EfPm-144 to 154) were located.

SITE TYPES: Surface scatters, cairns, possible ring, campsites and a surface depression

REPORT: Complete, entitled "Historical Resources Impact Assessment E1/2-5-23-1-W5M, Evergreen Estates at Calgary, Alberta Final Report, Permit 87-78," by Colin Poole and Richard Callaghan

87-79	**Milt Wright** **Archaeological Survey of Alberta**	**Alberta Culture and Multiculturalism** **Mitigation of Burial Sites**

PROJECT TYPE: Mitigation

LOCATION/SETTING: The burials are located near the confluence of the Notikewin and Peace rivers in the northeast portion of the Notikewin Provincial Park. Sites are situated on recent floodplain deposits of the right bank of the Peace River.

METHODOLOGY: The project included excavation and reburial of suspected 20th century coffin burials eroding from the bank of the Peace River, within Notikewin Provincial Park and with the cooperation of Municipal Affairs and Parks and Recreation. The area containing the burials was surficially examined for indications of additional interments or associated historical occupations. Natural exposures and grave chamber sediments were examined for presence of impacted historical resources not associated with the human interments.

RESULTS: The two historical human burials were determined to be of late 19th century derivation and not representative of known individuals. These interments are part of an historical Metis cemetery of indeterminant size which has been eroding into the Peace River for at least the last three years. The cemetery has been excavated into the stratified prehistoric deposits of HhQg-4 which are apparent in the river bank profile and burial chamber sediments. The two interments and associated coffin remains were interred in a registered cemetery. Knowledge gained from the conduct of this project is assisting in the formulation of a policy on the handling of human remains discoveries and burials within the province of Alberta.

SITE TYPES: Historical cemetery (HhQg-5) and prehistoric stratified campsite (HhQg-4)

REPORT: In preparation

87-80	**Peter T. Bobrowsky** **P.T.B. Consulting** **9932 - 112 Street** **Edmonton, Alberta**	**IMC Consulting** **Subdivision**

PROJECT TYPE: HRIA

LOCATION/SETTING: The proposed subdivision is located on the west side of Highway 2 and north side of Ellerslie Road, south of Edmonton.

METHODOLOGY: A total of 60 ha of land surface was examined by a two-man field party. Examination involved inspection of the ground surface over the entire area slated for impact. A total of 43 shovel test holes were excavated in the project area. Most of these were located in the western portion of the development area where current disturbance was minimal. Four test holes were placed in the vicinity of a newly discovered site.

RESULTS: One site, FiPl-32, was located at the extreme eastern end of the development area. The ground surface had been clear for several decades, and the area was in use as a horse pasture compound. Subsurface testing at the locality failed to uncover any cultural remains. The site consists of a few scattered lithic and bone fragments.

SITE TYPE: Prehistoric campsite, single component

REPORT: In preparation

87-81	Brian O.K. Reeves Lifeways of Canada Ltd. 317 - 37 Avenue, N.E. Calgary, Alberta	Suncor Inc. Resources Group Well Sites

PROJECT TYPE: HRIA

LOCATION/SETTING: The well sites are located northwest of Drumheller, on undisturbed prairie grassland.

METHODOLOGY: Foot traverse of proposed well sites were conducted, with judgemental shovel testing.

RESULTS: No historical resource sites were located.

REPORT: In preparation

87-82	Bea Loveseth Lifeways of Canada Ltd. Associates 317 - 37 Avenue, N.E. Calgary, Alberta	Alberta Power Limited Transmission Line

PROJECT TYPE: HRIA

LOCATION/SETTING: The transmission line runs from southeast of Valleyview to east of Peace River. Part of the Alberta High Plains, it is dominated by aspen/poplar parkland with muskeg harboring black spruce and tamarack. The area is mainly undisturbed.

METHODOLOGY: Foot traverse and judgemental shovel testing were conducted along 60 km of the proposed 160 km, 240 kV transmission line. All river and creek crossings were checked.

RESULTS: One prehistoric site (GiQf-2) was found.

SITE TYPE: Isolated find

REPORT: Complete, entitled "Historical Resources Impact Assessment, Proposed Little Smoky to Wesley Creek 240 kV Transmission Line Project," by Bea Loveseth

87-83

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

Daishowa Canada
Kraft Pulp Mill

PROJECT TYPE: HRIA

LOCATION/SETTING: The mill is north of the town of Peace River, on the west side of the Peace River valley known locally as Ferguson Flats. The river terraces are covered with native grasslands; 40 percent of the land has been cultivated but reverted to pasture

METHODOLOGY: In locating sites, judgemental and opportunistic foot traverses were conducted, complemented by shovel and backhoe testing. Assessment at known sites included 1 x 1 m excavations and shovel testing.

RESULTS: Two historical and seven prehistoric sites were identified. At HcQh-1, 73 lithic artifacts and two identifiable bones were recovered. Ten lithic artifacts were collected at HcQh-3.

SITE TYPES: Two historical farmsteads, three single component campsites (HcQh-1, 3 and 5), three multi-component campsites (HcQh-6 to 8) and one lithic scatter (HcQh-9)

DATES: 1920s to 1930s for the farmsteads

REPORT: Complete, entitled "Historical Resources Impact Assessment, Daishowa Canada Co. Ltd., Peace River Kraft Pulp Mill Site, Peace River, Alberta," by Bea Loveseth

87-84

Bea Loveseth
Lifeways of Canada Ltd.
317 - 37 Avenue, N.E.
Calgary, Alberta

H.A. Simons Ltd.
Railway Spur

PROJECT TYPE: HRIA

LOCATION/SETTING: The railway spur is north of the town of Peace River, on the west side of the Peace River. The terrain is river valley and uplands; vegetation is parkland (aspen forests); river flats are cultivated.

METHODOLOGY: Foot traverses of parts of the 14 km spur were conducted, as were judgemental shovel tests.

RESULTS: Two prehistoric sites were located.

SITE TYPES: Campsite (HbQn-15) and isolated find (HbQh-14)

REPORT: In preparation

87-85

Barry J. Dau
Ethos Consultants Ltd.
Group Box 20, Veinerville
Medicine Hat, Alberta

Alberta Environment
Buried Camp Mitigation,
Oldman River Dam

PROJECT TYPE: Research at site DjPl-9

LOCATION/SETTING: Site DjPl-9 is located on a small terrace on the floor of the Oldman River valley, north of the village of Pincher Station. The site is within the proposed reservoir for the Oldman River Dam.

METHODOLOGY: Previous work at site DjPl-9 in 1985 and 1986 had indicated that it might contain cultural materials up to 5,000 years of age. As the site is within a proposed borrow area for dam construction, a mitigation programme was undertaken. The 1987 project involved the excavation of 29 1 x 1 m test pits to depths of 40-70 cm below surface in the area of the site indicated by the 1985-86 programme as containing the highest densities of cultural material. Emphasis in 1987 was placed on recovering cultural diagnostics and a large enough sample of faunal material to determine cultural activities and seasonality. In addition to the test excavations, three backhoe pits were dug near the edge of the terrace overlooking the river in order to search for deeply buried cultural materials. Maximum depths of the backhoe pits varied from 300-500 cm.

RESULTS: During the course of the excavations, a total of 283 pieces of cultural material were recovered. They consisted primarily of fire-cracked rock and debitage. A single diagnostic projectile point was recovered from a depth of 10-20 cm below surface. It is a poorly made specimen similar to points from the Besant Phase (2,000 - 1500 years B.P.) No faunal remains were recovered from either the excavations or a brief surface collection programme undertaken along the edge of terrace overlooking the Oldman River. No deeply buried cultural materials were found in the backhoe tests. Based upon the 1987 mitigation programme, site DjPl-9 appears to have been a sparsely occupied camp probably utilized for only brief periods of time.

SITE TYPE: Campsite

REPORT: Complete, entitled "1987 Mitigation Program at Archaeological Site DjPl-9 Oldman River Dam, Alberta - ASA Permit 87-85," by Barry J. Dau

87-86	**Thomas Head** **Bison Historical Services** **236 - 11A Street, N.W.** **Calgary, Alberta**	**Shell Canada Limited** **Clearwater and Panther River Pipeline Projects**

PROJECT TYPE: Mitigation of impacts, prehistoric sites EjPu-1, EjPt-4 and ElPu-14,

LOCATION/SETTING: The prehistoric sites are situated in treed area of foothills west of a Forestry trunk road. ElPu-14 is on a terrace on the north side of Clearwater River. EjPu-1 is located on a grass-covered, low terrace on the south side of North Burnt Timber Creek. EjPt-4 is located on high ridge on the north side of McCue Creek.

METHODOLOGY: A total of 16 square metres at ElPu-14, 4.75 square metes at EjPu-1 and 2.0 square metres at EjPt-4 were excavated. Horizontal provenience was 50 cm, and vertical provenience was 10 cm.

RESULTS: ElPu-14 yielded 248 lithic artifacts, including projectile points attributed to a Middle Prehistoric occupation. The site consists of several distinguishable activity areas. Site EjPu-1 consists of a Late Prehistoric and a Late Middle Prehistoric component. The upper component is dominated by large ungulate bone. The lower component consists of 81 lithic specimens which include five tools. Three of these are biface fragments. Two of the biface fragments conjoin and appear to be a blank for a large atlatl point. The faunal assemblage includes evidence of small and large mammals and molluscs. EjPt-4 consists of 32 lithic specimens, all debitage.

SITE TYPES: Campsites (ElPu-1 and EjPu-1), small lithic workshop (EjPt-4)

REPORT: Complete, entitled "Final Report, Mitigation of Impacts, Results of Archaeological Excavations, ElPu-14, EjPu-1 and EjPt-4, ASA Project Number 87-86," by Thomas Head

87-87	Terrance H. Gibson 9932 - 112 Street Edmonton, Alberta	Monenco Consulting Ltd. Beavertail Gas Plant Site 3

PROJECT TYPE: HRIA

LOCATION/SETTING: The gas plant is situated on a small parcel of cultivated land, 10 km west of Hythe.

METHODOLOGY: The cultivated field was traversed by a series of parallel foot traverses spaced at 50 m. The ground surface was inspected, and shovel tests were conducted in obscured areas and in areas of high ground.

RESULTS: Despite good assessment conditions, no palaeontological or cultural resources were discovered.

REPORT: Complete, entitled "Project 87-87 Historical Resources Impact Assessment of the Proposed Beavertail Gas Plant Site 3, near Hythe, Alberta," by Terrance H. Gibson

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